UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

2013-1459

AZURE NETWORKS, LLC and
TRI-COUNTY EXCELSIOR FOUNDATION,

Plaintiffs-Appellants,

v.

CSR PLC and
CAMBRIDGE SILICON RADIO INTERNATIONAL, LLC,

Defendants-Appellees,

and

ATHEROS COMMUNICATIONS, INC. and
QUALCOMM INCORPORATED,

Defendants-Appellees,

and

BROADCOM CORPORATION,

Defendant-Appellee,

and

MARVELL SEMICONDUCTOR, INC.,
RALINK TECHNOLOGY CORPORATION (TAIWAN), and
RALINK TECHNOLOGY CORPORATION (USA),

Defendants-Appellees.

Appeal from the United States District Court for the Eastern District of Texas
in case no. 11-CV-0139, Judge Michael H. Schneider.

BRIEF OF PLAINTIFFS-APPELLANTS
AZURE NETWORKS, LLC AND
TRI-COUNTY EXCELSIOR FOUNDATION

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August 20, 2013

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CERTIFICATE OF INTEREST

Counsel for Plaintiffs-Appellants Azure Networks, LLC, and Tri-County Excelsior Foundation certifies the following:

1. The full name of every party or *amicus* represented by me is:

   Azure Networks, LLC

   Tri-County Excelsior Foundation

2. The name of the real party in interest represented by me is:

   Azure Networks, LLC

   Tri-County Excelsior Foundation

3. All parent corporations and any publicly held companies that own 10% or more of the stock of the party or *amicus curiae* represented by me are:

   Not applicable.

4. The names of all law firms and the partners or associates that appeared for the party or *amicus* now represented by me in the trial court or agency or are expected to appear in this Court are:

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STATEMENT OF RELATED CASES

Appellees Broadcom Corp., Qualcomm Inc., and Qualcomm Atheros, Inc., petitioned this Court for a writ of mandamus concerning the district court's denial of their motion to dismiss or transfer the case pursuant to 28 U.S.C. §§ 1404(a) and 1406(a). On April 23, 2013, this Court denied the petition. *In re Broadcom Corp., Qualcomm Inc., and Qualcomm Atheros, Inc.*, Case No. 13-141 (Fed. Cir. 2013) (Prost, Moore, O'Malley, JJ.). Broadcom petitioned the Supreme Court of the United States for a writ of certiorari to review that decision. As of the filing of this brief, the Supreme Court has not ruled on Broadcom's petition.

STATEMENT OF JURISDICTION

The district court's jurisdiction was based on 28 U.S.C. § 1338(a). The district court entered final judgment dismissing all claims for non-infringement on May 30, 2013. On June 20, 2013, Azure Networks, LLC ("Azure") and Tri-County Excelsior Foundation ("Tri-County") filed a timely notice of appeal. This Court has jurisdiction under 28 U.S.C. § 1295(a)(1).

STATEMENT OF THE ISSUES

1. Whether the district court erred by dismissing licensor Tri-County—who holds title, reversionary interests, and monetary interests in the asserted patent—for lack of standing to join the infringement action brought by its exclusive licensee, Azure, when the license agreement specifically contemplates that Tri-County can join in the suit.

2. Whether the district court erred (a) in construing "MAC address" to have a special meaning in the patent that differs from the use of that term in the field and all the prior art cited by the patent and (b) in defining that special meaning to limit the claims to one embodiment disclosed in the specification.

INTRODUCTION

Tri-County is the owner and licensor of U.S. Patent No. 7,756,129 ("the '129 patent"), which relates to connecting digital electronic devices, such as computers and peripheral devices, using a personal wireless network. Although the exclusive licensee, Azure, can independently bring an infringement suit, the license agreement leaves Tri-County with substantial interests in the '129 patent, including present financial interests as well as extensive future interests. Upon the expiration of the Exclusive License ("the Agreement") in March 2018, Tri-County will regain all rights in the patent unless, in its sole discretion, Tri-County decides to renew the Agreement for one or more one-year periods. Tri-County may also unilaterally terminate the Agreement at any time for cause. Finally, under the Agreement, Tri-County retains a substantial financial stake in the outcome of any litigation related to the '129 patent. The district court nonetheless dismissed Tri-County from the lawsuit, finding that it lacked standing to assert infringement of the '129 patent. The district court reached this result by improperly holding that—despite the rights that Tri-County retained under the Agreement—it was tantamount to an assignment of the patent. The district court then went further, ignoring Tri-County's interest under the Agreement, to hold that Tri-County had *no rights at all* under the Agreement sufficient to have standing. On this basis,

the district court determined that the holder of title in the patent could not join in suit as a co-plaintiff.

The district court also erred in construing the claim term "MAC address" to require that it be an address "generated by the hub device." The district court's construction was based on its erroneous conclusion that the patentee acted as his own lexicographer in coining the term—even though MAC addresses are a well-known way to identify network devices, and the term was used consistent with its standard industry meaning, just as it is used throughout the prior art cited on the face of the patent. The district court then compounded its error by limiting the meaning of "MAC address" to preferred embodiments in which the hub device generates the MAC address rather than using a previously generated MAC address to identify network devices. There is no basis to limit the claims to those preferred embodiments, particularly when the intrinsic evidence demonstrates that MAC addresses need not be generated every time they are used.

STATEMENT OF THE CASE

Appellants Azure and Tri-County sued CSR PLC, Cambridge Silicon Radio International, LLC, Atheros Communications, Inc., Broadcom Corporation, Marvell Semiconductor, Inc., Qualcomm Inc., and Ralink Technology

Corporation[1] (collectively, "appellees" or "defendants") for infringing the '129 patent by making and selling certain computers chips that operate on one of the Bluetooth standards. A0157-58, A0160-65. The appellees moved to dismiss Tri-County for lack of standing, claiming that Tri-County had assigned Azure the '129 patent through the Agreement. Magistrate Judge Love determined that this license was tantamount to an assignment, that Tri-County therefore was not a necessary party, and that Tri-County did not have standing to sue for infringement of the '129 patent as a co-plaintiff with the exclusive licensee, Azure. The district court adopted the report and recommendation, dismissing Tri-County from the suit.

The district court also construed certain claim terms of the '129 patent, including "MAC address." Tri-County and Azure argued that the term should be construed consistent with its standard meaning in the art as "an address that uniquely identifies a device or group of devices on a shared communication medium." The appellees, in contrast, contended that the patentee acted as his own lexicographer by expanding the "MAC" acronym to be "Media Access" rather than the customary "Medium Access Control" or "Media Access Control." Relying on that deviation and on embodiments in the specification, the appellees proffered the construction "a device identifier created by the hub device." After a *Markman* hearing, Magistrate Judge Love held that the patentee acted as a lexicographer and

[1] Texas Instruments, Inc., was also a defendant, but was earlier dismissed from the case.

construed the term as "a device identifier generated by the hub device." A0008. Azure and Tri-County moved for reconsideration of the construction of "MAC address." The district court denied the motion and adopted the magistrate judge's construction of MAC address.[2]

Azure and Tri-County stipulated to a judgment of non-infringement based on the erroneous construction of the claim term "MAC address." Tri-County and Azure now appeal that judgment, and Tri-County also appeals the district court's dismissal order.

STATEMENT OF FACTS

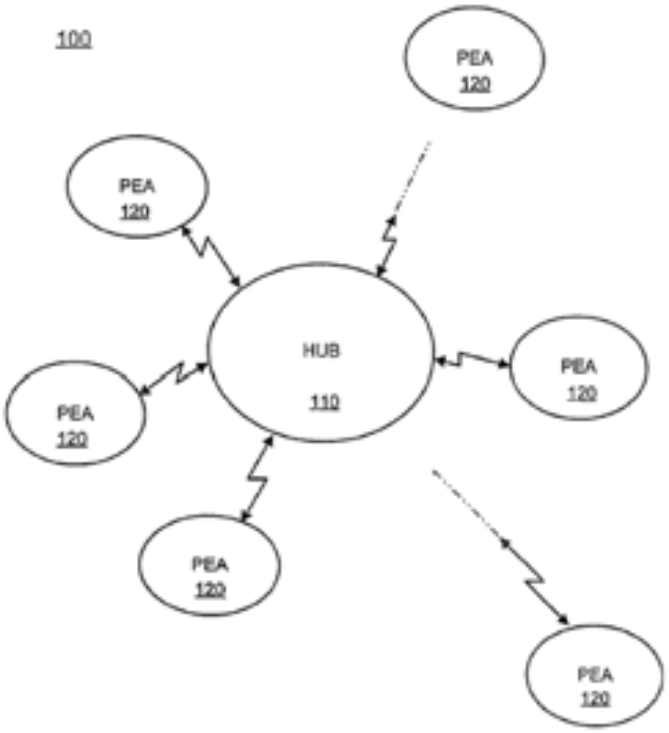
A. U.S. Patent 7,756,129

The inventor of the '129 patent, Robert J. Donaghey, conceived of a new way for a computer processor to communicate with multiple peripheral devices in the course of his work on a project known as BodyLAN (for Body-Local Area Network). The BodyLAN project was started by BBN Systems and Technologies (now Raytheon BBN Technologies) as one of the earliest efforts to develop geographically small wireless networks that allowed multiple peripheral devices to communicate with a central computing device via a shared network. At the time, cables were typically necessary to connect peripheral devices, such as a printer or

[2] The district court further clarified that the term "generated" as it is used in the Magistrate Judge Love's construction requires "that the MAC address must be created or assigned by the hub device." A0026.

barcode scanner, with a computer. Furthermore, traditional wireless networks were limited to connecting a single peripheral device using a dedicated wireless channel. A0136 (’129 patent 1:30-42). The early development of the BodyLAN technology was directed toward military applications where neither wired nor traditional wireless technology was practical, such as communicating navigational data from a Personal Electronic Accessory (“PEA”) device located on a soldier’s boot to a belt-mounted computer. Mr. Donaghey’s work on the BodyLAN project resulted in numerous patents, including the ’129 patent.

The ’129 patent describes a method of facilitating wireless communication between two or more digital electronic devices in close proximity to one another. The ’129 patent refers to this close network of devices as a personal area network or “PAN.” A0137 (’129 patent 3:10-16). Figure 1 of the ’129 patent illustrates a typical network. A0136 (’129 patent 2:22-24).



A0119 (’129 patent Fig. 1). As shown in Figure 1, a PAN generally consists of a “hub” device surrounded by one or more peripheral PEA devices. A0137 (’129 patent 3:10-13; 3:27-31). The hub “orchestrates all communication in the PAN,” which may include “manag[ing] the timing of the network, allocat[ing] available bandwidth among the currently attached [peripheral devices] participating in the PAN [], and support[ing] the attachment, detachment, and reattachment of PEAs [] to and from the PAN.” *Id.* 3:33-39. In turn, the peripheral devices “may vary dramatically in terms of their complexity” and may consist of “stationary devices located near the Hub,” such as personal computers, “and/or portable devices that move to and away from the Hub,” such as personal digital assistants and cellular telephones. *Id.* 3:44-52. “Each device is identified by a Media Access (MAC) address.” *Id.* 3:31-32.

In order for the hub and peripheral devices to communicate on the PAN, they must connect or "attach" with one another. A0140 ('129 patent 10:45-52). Independent claims 14 and 27 disclose a hub device and a peripheral device configured to perform this "attachment" process. Independent claim 14 is directed to the hub device:

> 14. A **hub device** for use within a personal area network, comprising:
> circuitry, and
> a transceiver in communications with the circuitry, the hub device configured to cause the transceiver to
> i) send a message to indicate the availability of the hub device for peripheral device attachment,
> ii) receive, from a first peripheral device, a message indicating the availability of the first peripheral device for communication with the hub device,
> iii) send, to the first peripheral device, a signal including a first peripheral device identifier,
> iv) receive, from the first peripheral device, a response,
> v) send a hub response to the first peripheral device, and
> vi) receive, from the first peripheral device, a second peripheral response including the first peripheral device identifier.

A0142 ('129 patent claim 14) (emphasis added). Claim 27 is directed to a peripheral device:

> 27. A **peripheral device** for use within a personal area network, comprising:
> circuitry, and
> a transceiver in communication with the circuitry, the peripheral device configured to cause the transceiver to
> i) receive a sent message from a hub device to indicate the availability of the hub device for peripheral device attachment,

ii) send, to the hub device, a message indicating the availability of the peripheral device for communication with the hub device,
iii) receive, from the hub device, a signal including a peripheral device identifier,
iv) send a response to the hub device,
v) receive, from the hub device, a hub response, and
vi) send, to the hub device, a second peripheral response including the peripheral device identifier.

A0143 ('129 patent claim 27) (emphasis added). As the parties agreed, the term "peripheral device identifier" in these claims means "an element that identifies a peripheral device." A1446. Claims 43 and 221 depend from claims 14 and 27, respectively, and introduce the disputed term "MAC address." These claims recite that a "plurality of MAC addresses" are "capable of being used for identification in association" with a peripheral device. A0143 ('129 patent claim 43), A0148 ('129 patent claim 221). In other words, the "plurality of MAC addresses" introduced by claims 43 and 221 are "capable of being used to distinguish the [] peripheral device from other devices." A0013. In the district court, Azure and Tri-County accused the appellees of infringing claims 43 and 221 and related dependent claims. [3]

[3] Azure and Tri-County accused the appellees of infringing claims 43, 45-49, 51-53, 55, 57-59, 61, 63-64, 75, 79, 81, 95, 111, 124-129, 132, 134, 137, 140, 145-148, and 156, all of which depend from claim 14, and claims 221, 223-227, 229, 233, 236-237, 257, 259, 262-263, 302-304, 306, 311, 323, 334, all of which depend from claim 27.

The specification describes different exemplary aspects of the patented invention. For example, the "Exemplary Attachment Processing" describes possible means by which a PEA can attach to the hub to enable communications. Included are instances where the hub schedules attachment opportunities with unattached PEAs by using a small set of attach MAC ("AMAC") addresses. A0140 ('129 patent 10:48-52). In this exemplary embodiment, an unattached PEA selects one of the designated AMAC addresses at random to identify itself and sends an "attach-interest" and "attach-request" message using its AMAC address. *Id.* 10:53-57. Upon receipt of the messages, the hub assigns a MAC address to the PEA by sending the address using the AMAC address and awaits confirmation via a message from the PEA using its MAC address. A0141 ('129 patent 11:2-11). The hub and PEA engage in one final exchange of messages via the PEA's MAC address to confirm the PEA is attached; the "MAC address remains assigned to that PEA [] for the duration of the time that the PEA [] is attached." *Id.* 11:11-16. Similarly, the Summary of the Invention describes various alternative implementations of the attachment process. *See* A0136 ('129 patent 1:50-2:14). In the Conclusion, the specification is clear that "[t]he foregoing description of exemplary embodiments of the present invention provides illustration and description, but is not intended to be exhaustive or to limit the invention to the precise form disclosed." A0142 ('129 patent 13:29-32).

B. The Exclusive License

In 2010, Azure donated patents and applications, including the application that later issued as the '129 patent, by assignment to Tri-County, a non-profit organization. After considering its available licensing opportunities, Tri-County entered into an Exclusive License ("the Agreement") to license the '129 patent (among others) to Azure.

Pursuant to the Agreement, Azure receives:

> a worldwide, transferable, exclusive license under the Patent(s)/Application(s), with the right to sublicense others, to (i) make, have made, use, sell, offer to sell, import and lease any products, (ii) use and perform any method, process, and/or services, and (iii) otherwise practice any invention in any manner, such that Azure has full right to enforce and/or sublicense the Patent(s)/Application(s) without any restriction.

A1201 § 2.1. Azure also obtains the exclusive right to control and is responsible for the associated expenses for filings, prosecution, and maintenance in connection with the licensed patents and applications. *Id.* § 2.2. Tri-County retains a royalty-free, personal, non-transferable, and non-exclusive right to practice the methods and processes covered by the patents and applications, as well as the right to make, sell, and use Tri-County-branded products covered by the patents and applications. *Id.* § 2.3.

As part of Azure's exclusive right to maintain, enforce, and defend the licensed patents and applications, Azure can pursue and collect damages, royalties, payments, and injunctions for past, current, and future infringement. A1204 § 4.4.

In exchange, Azure is obligated to exercise good faith business judgment to monetize the patents and must pay Tri-County 33% of any licensing fees, royalties, or other proceeds it obtains from third parties as a result of these monetization efforts. A1202 § 3.1, A1204 § 4.4. To ensure Azure is acting consistent with its obligations, Azure must annually report its monetization efforts and proceeds to Tri-County. A1203 § 3.4. Tri-County is obligated to participate in Azure's enforcement proceedings if Azure determines that Tri-County's participation is necessary or desirable to address a legal issue such as to "establish sufficient standing to enforce the Patent(s)/Application(s) against third parties." A1204 § 4.4.

The Agreement also provides each party with termination rights. Azure has the right to terminate the Agreement if, after joining Tri-County in litigation, a court finds that Azure does not have standing as a co-plaintiff. A1208 § 7.10. Tri-County has the right to terminate the Agreement if it determines that Azure has breached its duty to exercise good faith business judgment in monetizing the patents. A1207 § 7.8. Tri-County also has an exclusive right to terminate if it determines that the Agreement imposes tax-related risks on Tri-County. *Id.* § 7.9. If either party exercises its exclusive termination right, the Agreement provides that Azure "shall have an option to acquire all right, title and interest under the particular Patent(s)/Application(s) for the option exercise price of $305,000.00."

Id. § 7.9, A1208 § 7.10. If Tri-County or Azure do not invoke these rights, the Agreement will terminate on March 27, 2018, two years prior to the expiration of the '129 patent.[4] Tri-County, however, has the additional right to unilaterally renew the Agreement in one-year increments upon thirty-days' notice. A1207 § 7.8.

C. The Accused Products

The appellees make and sell various products that use the Bluetooth v3.0 + HS standard. This version of the Bluetooth standard covers wireless technology that transfers data for short distances via low-power radio waves and can connect several devices simultaneously. When Bluetooth-enabled devices come within range of one another, they are capable of automatically connecting to form a personal area network known as a "piconet" in the standard. One of the devices initiates the connection and is then considered the "master." A9252, A9299. The master discovers and pages the other device (called the "slave" device); after the slave device responds, the master sends a second page to the slave, and the slave responds. After this connection, the master can send data back and forth with the slave. A9384-85. Up to seven active slave devices can connect to a master at any given time. A9293.

[4] Due to terminal disclaimer, the '129 patent expires on March 27, 2020.

To coordinate device identification and data transmission, each Bluetooth-enabled device has a unique Bluetooth device address. A9296-97. This address is referred to in the standard as "BD_ADDR" and acts as a unique device identifier. This address is also known as the device's MAC address. The term "MAC address" is normally expanded (i.e., spelled out) in the literature as either "Media Access Control address" or "Medium Access Control address." *See* A9199; A1963.

MAC addresses originated during the development of the Ethernet standards and were later defined in specifications promulgated by the Institute of Electrical and Electronics Engineers ("IEEE"). A1600. Under the IEEE specification, MAC addresses can be assigned to individual devices or to groups of devices. A1605. Additionally, under the specification, network devices can be assigned a "universal" MAC address at the time the device is manufactured or a device can be assigned a MAC address by computer servers in the device's local network. A1604-05, A1607. The Bluetooth standard uses "universal" MAC addresses rather than locally defined MAC addresses. A9138, A9296, A10710.

D. The District Court Proceedings

On March 22, 2011, Tri-County and Azure filed this lawsuit, alleging that some of the appellees' Bluetooth products infringe the '129 patent. The appellees moved to dismiss Tri-County for lack of standing, arguing that Tri-County's

transfer of rights to Azure under the Agreement deprived it of the ability to sue as co-plaintiff on the '129 patent. Tri-County responded, asserting that it has standing because the Agreement is an exclusive license, not an assignment, which leaves Tri-County with legal ownership of (and exclusion rights in) the '129 patent.[5]

On January 16, 2013, Magistrate Judge Love issued a report and recommended that the district court dismiss Tri-County for lack of standing. Rather than focus on whether Tri-County had standing to sue, the magistrate judge instead focused on whether Tri-County was a necessary party under Federal Rule of Civil Procedure 19. In this analysis, Magistrate Judge Love discounted Tri-County's title in the patent and its financial and reversionary interests in the patent. The magistrate judge concluded that the Agreement was actually an assignment of the '129 patent to Azure and, thus, that "[Tri-County] is not a necessary party under Rule 19." A0034. Magistrate Judge Love further concluded that Tri-County did not have any interest in the patent sufficient for it to have standing and recommended dismissal. A0035. On March 6, 2013, over Tri-County's objections, the district court adopted the report and recommendation and granted the appellees' motion to dismiss Tri-County. *See* A0036. The case then proceeded with Azure as the lone plaintiff.

[5] Tri-County also argued that, not only did it have standing, but that it was a necessary party to the suit.

The parties proposed competing constructions of several claim terms, including "MAC address." Azure asserted that the term should receive the same meaning that it has throughout the industry and the prior art, i.e., "an address that uniquely identifies a device or group of devices on a shared communication medium." A1500. The appellees countered that the patentee acted as his own lexicographer because the patentee expanded the acronym "MAC address" to "Media Access address," rather than either "Medium Access Control address" or "Media Access Control address." Based on this expansion of the acronym and the fact that the embodiments detailed in the specification describe an address assigned to a peripheral device by the hub, the appellees proposed that the term be construed as "[a] device identifier created by the hub device." A0008.

Magistrate Judge Love held a *Markman* hearing, after which he construed several terms. The magistrate judge and district court largely agreed with the appellees' construction of "MAC address," defining it as "a device identifier generated by the hub device." *Id.*; A0025-26. Because the accused Bluetooth devices use a universal MAC address, rather than a MAC address generated by a local network device, Azure stipulated to judgment of non-infringement based on that construction. The district court granted the motion to dismiss and entered final judgment.

Tri-County and Azure timely appealed.

SUMMARY OF ARGUMENT

I. Tri-County has standing to sue for infringement of the ’129 patent. The Agreement provides Azure with an exclusive license, but leaves Tri-County with legal title to and substantial rights in the ’129 patent. In particular, Tri-County obtains all rights back in the patent when the license automatically terminates; it can terminate the license at any time if it determines Azure is not earning enough income on the patent from litigation and licensing; it is entitled to 33% of proceeds from the patent; and it retains the right to practice the patented invention. Indeed, the Agreement specifically contemplates that Tri-County may bring suit along with Azure to enforce their exclusionary rights. Moreover, the Agreement expressly provides for specific situations when Azure may purchase the patent from Tri-County for a substantial price—which would be a needless provision if the parties already considered Azure the true owner of the ’129 patent.

Despite Tri-County’s reservation of the title and rights in the patent and the clear intent of the parties, the district court held that the Agreement was actually an assignment of the patent to Azure. The district court then took the additional step to hold that Tri-County—the holder of legal title—held *no rights* in the patent sufficient for Tri-County even to join suit with Azure. The Agreement demonstrates otherwise. Taken together, Tri-County’s reservation of rights leads to the conclusion that Tri-County should be allowed to participate in the suit.

This Court should correct that error and reverse the district court's dismissal of Tri-County.

II. The patent claims recite a "MAC address" that is used to identify the peripheral devices vis-à-vis the hub. This term is used ubiquitously throughout networking technology and the prior art cited on the face of the '129 patent. And, it consistently refers to an address that uniquely identifies a device or group of devices on a shared communication medium. There was no reason to introduce the additional requirement that the MAC address must be generated by the local hub device, when it is well-known in the art that MAC addresses can either be assigned to a network device "locally" by a network hub or assigned "universally" when the network device is manufactured.

The district court's holding to the contrary was based on two errors. First, contrary to the district court's conclusion, the fact that the patentee dropped a word in expanding the acronym "MAC address" to "Media Access address" (as opposed to "Media Access Control address") does not clearly impart a special meaning to the term. This is particularly the case because the MAC addresses in the '129 patent perform the same function that they do throughout the cited prior art—namely, uniquely identifying network devices for communication. Second, even if the term "MAC address" was given a distinct definition in the '129 patent, there was still no basis to limit that term to preferred embodiments. While the

embodiments describe the local hub device generating MAC addresses, the specification identifies these embodiments as "exemplary." This Court should properly construe "MAC address," vacate the judgment of non-infringement, and remand for further proceedings based on the proper construction.

ARGUMENT

I. STANDARD OF REVIEW

Standing is a question of law that this Court reviews de novo. *Alfred E. Mann Found. for Scientific Research v. Cochlear Corp.*, 604 F.3d 1354, 1358 (Fed. Cir. 2010). This Court also reviews claim construction de novo. *Cybor Corp. v. FAS Techs., Inc.* 138 F.3d 1448, 1455-56 (Fed. Cir. 1998) (en banc).

II. TRI-COUNTY HAS STANDING BASED ON ITS INTEREST IN THIS LITIGATION AND ITS OWNERSHIP OF THE '129 PATENT

The district court erred in two respects in holding that Tri-County lacked standing in this litigation. First, the district court improperly determined that the Agreement was actually an assignment, rather than an exclusive license to Azure, making Azure alone the "patentee" with standing to sue for infringement. In doing so, the district court did not "ascertain the intention of the parties" to determine whether the Agreement acted as an assignment, but instead focused on only a few of the many rights retained by Tri-County under the Agreement. *Sicom Sys., Ltd. v. Agilent Techs., Inc.*, 427 F.3d 971, 976 (Fed. Cir. 2005) (citation omitted).

Moreover, the district court's analysis of individual terms consistently undervalued the rights retained by Tri-County.

Second, the district court exacerbated its error by holding that Tri-County did not hold *any* interests in the patent sufficient to join in this suit with Azure. The district court arrived at that conclusion by ignoring the rights retained by Tri-County, and instead focusing on rights that Tri-County had given up. Thus, the district court reached the untenable result that the record owner of legal title in the '129 patent did not have standing to sue on the patent as a co-plaintiff.

A. The District Court Erred in Finding That the License Is an Assignment

Standing in patent cases is derived from 35 U.S.C. § 281, which provides that "[a] patentee shall have remedy by civil action for infringement of his patent." *See Intellectual Prop. Dev., Inc. v. TCI Cablevision of Cal., Inc.*, 248 F.3d 1333, 1345 (Fed. Cir. 2001). The term "patentee" includes "not only the patentee to whom the patent was issued but also the successors in title to the patentee." 35 U.S.C. § 100(d). Because Tri-County obtained legal title to the '129 patent on June 10, 2010, when it was assigned the '129 patent application, Tri-County presumptively has standing to bring suit. This default rule is changed only when the patentee has transferred "all substantial rights" to the patent to another party. *Propat Int'l Corp. v. RPost, Inc.*, 473 F.3d 1187, 1189 (Fed. Cir. 2007). In that case, the assignee is treated as the "effective patentee" who has standing to bring

suit. *Morrow v. Microsoft Corp.*, 499 F.3d 1332, 1340 n.6 (Fed. Cir. 2007). "Any[thing] less than a complete transfer of these rights is [a] mere[] . . . license, in which case . . . title remains with the owner of the patent and . . . suit must be brought in its name." *Enzo APA & Son, Inc. v. Geapag, A.G.*, 134 F.3d 1090, 1093 (Fed. Cir. 1998).

In holding that the Agreement transferred all substantial rights to Azure, the district court focused on just two of the many rights allocated to Azure by the Agreement—namely, certain enforcement and licensing rights. As an initial matter, the district court's methodology was flawed. It simply catalogued a few of the individual rights allocated by the Agreement and held that enough of them were given to Azure that the Agreement was tantamount to an assignment. But the district court failed to consider, much less ascertain, the intention of the parties in deciding whether the Agreement was an assignment rather than a license. *See Sicom Sys.*, 427 F.3d at 976.

In addition, the district court failed to address numerous factors that this Court has relied on in determining whether a license transfers all substantial rights, including the exclusive right to make, use and sell products or services,

> the scope of the licensee's right to sublicense, the nature of license provisions regarding the reversion of rights to the licensor following breaches of the license agreement, the right of the licensor to receive a portion of the recovery in infringement suits brought by the licensee, the duration of the license rights granted to the licensee, the ability of the licensor to supervise and control the licensee's activities, the obligation of

> the licensor to continue paying patent maintenance fees, and the nature of any limits on the licensee's right to assign its interests in the patent.

Alfred E. Mann Found., 604 F.3d at 1360-61. These additional factors demonstrate that Tri-County did not transfer all substantial rights.

1. The district court failed to consider the parties' intent in entering the Agreement. *See Vaupel Textilmaschinen KG v. Meccanica Euro Italia S.P.A.*, 944 F.2d 870, 874 (Fed. Cir. 1991) ("a transfer will suffice as a sale if it appears from the agreement and surrounding circumstances that the *parties intended* that the patentee surrender all his substantial rights") (citing *Bell Intercontinental Corp. v. United States*, 381 F.2d 1004, 1011 (Ct. Cl. 1967) (emphasis in original)).

The Agreement clearly manifests the parties' intent to create a license rather than an assignment. First, the Agreement is called an Exclusive License. A1201. The Agreement further specifies that Tri-County is the owner of the '129 patent. *Id*. § 1.1.

Moreover, the Agreement contemplates certain situations in which Azure can *become* the owner of the patent. If Tri-County terminates the Agreement due to the effects on its tax-exempt status, the Agreement provides Azure with an "option to acquire all right, title and interest" in the patents for $305,000. A1207 § 7.9, A1208 § 7.10 (same if Azure terminates). If the Agreement were intended to assign Azure all rights in the patent, then there would be no rights, title, or interest for Azure to acquire in case of termination. Put another way, the fact that the

Agreement specifies how the patent may be assigned to Azure in the future for additional money indicates that the Agreement itself is not a present assignment of the patent.

The Agreement also provides Azure with a right to terminate if Azure does not have standing to sue for infringement of the '129 patent even if after joining Tri-County—that is, if Tri-County has conveyed too few rights in the patent to Azure. A1208 § 7.10 ("Azure retains the right to terminate this Agreement if, after any joinder of [Tri-County] occurs per Section 4.4, a court finds that Azure does not have standing as a co-plaintiff under this Agreement."). Because an assignment clearly transfers all substantial rights in a patent, parties intending to assign a patent would never need to provide for this termination right. By contrast, if the intent of the parties was to enter into an exclusive license, then this provision is logical because it ensures that if the license is found to convey insufficient rights to allow Azure to sue even with Tri-County joined as a party, then Azure can terminate. The same rationale explains another provision of the Agreement: Tri-County is obligated to participate in an infringement action brought by Azure on the licensed patents if necessary to establish sufficient standing to enforce the patents at issue. A1204 § 4.4. If the parties intended the Agreement to constitute an assignment, there would be no need to provide for Tri-County's participation

in legal actions to establish standing; the parties would have assumed that Azure would have standing to sue on its own.

Finally, Tri-County retains numerous rights described in detail below. *See infra* pp. 25-34. Taken together, these provisions demonstrate the parties' intent that the Agreement be an exclusive license rather than an assignment. The district court erred in holding otherwise.

2. Not only did the district court employ the wrong test to determine whether the Agreement is an assignment or a license—namely, a mere cataloguing of rights—even the substance of that analysis was flawed. The district court failed to consider all the factors deemed relevant by this Court in determining whether all substantial rights are transferred.[6]

First, nothing in the Agreement purports to divest Tri-County of title. Rather, the Agreement expressly provides that Tri-County is the owner of the patent. The fact that the Agreement expressly provides for Tri-County to retain

[6] District courts have construed agreements allocating rights to the licensor nearly identical to those that Tri-County retained here as exclusive licenses rather than assignments. *See, e.g.*, *Toshiba Corp. v. Wistron Corp.*, 270 F.R.D. 538, 54-43 (C.D. Cal. 2010) (construing agreement as license where licensor retained, *inter alia*, ability to practice invention, had right to royalties from licensing efforts, could decide not to renew agreement with advance notice, could unilaterally terminate, and obligated the licensee to act in good faith towards licensor's interests in enforcement); *Resonant Sensors Inc. v. SRU Biosystems, Inc.*, 651 F. Supp. 2d 562, 571-72 (N.D. Tex. 2009) (construing agreement as license where licensor retained, *inter alia*, right to non-commercial use of patented invention and had ability to terminate at its discretion after two-year period).

ownership indicates that all substantial rights have not been assigned. *See Propat Int'l Corp.*, 473 F.3d at 1190-91 ("Authentix retains sufficient rights in the patent that it cannot be said to have assigned 'all substantial rights' in the patent to Propat. To begin with, the agreement expressly provides that Authentix is, and will continue to be, the owner of the patent."). It is not the case that the Agreement simply is labeled an "exclusive license" despite containing provisions that actually transfer title. *See A123 Sys., Inc. v. Hydro-Quebec*, 626 F.3d 1213, 1218 (Fed. Cir. 2010). Instead, the Agreement provides that Tri-County is the record owner of the patent. The district court entirely failed to address this factor.

Second, Tri-County has the right to practice the '129 patent and make, sell, and use Tri-County-branded products covered by the '129 patent. A1201 § 2.3. Tri-County's retention of the right to practice the patented invention is another indication that the Agreement is not an assignment. *See Fieldturf, Inc. v. Sw. Recreational Indus., Inc.*, 357 F.3d 1266, 1269 (Fed. Cir. 2004); *Abbott Labs. v. Diamedix Corp.*, 47 F.3d 1128, 1132 (Fed. Cir. 1995); *see Independent Wireless Tel. Co. v. Radio Corp. of Am.*, 269 U.S. 459, 465-66 (1926) (patentee who retained non-exclusive, non-transferable and personal rights to make, use, and sell patented invention required to be joined with licensee who had exclusive license to make, use, and sell devices for the life of the patent); *see also Resonant Sensors Inc.*, 750 F. Supp. 2d at 572 (licensor's retention of rights to non-commercial,

educational use of patents "actually demonstrate an absence of complete exclusivity, which in this Court's view is key to the issue of whether there was a conveyance of all substantial rights"); *Great Lakes Intellectual Prop. Ltd. v. Sakar Int'l, Inc.*, 516 F. Supp. 2d 880, 887-88 (W.D. Mich. 2007) (collecting cases).

Third, Tri-County's transfer of litigation and licensing rights—upon which the district court placed great weight—cannot constitute an assignment because Azure's enjoyment of these rights is temporally limited. Tri-County may terminate the Agreement before the patent expires or the Agreement will automatically terminate before the patent expires if Tri-County does not renew the Agreement.

Tri-County has significant termination rights under the Agreement. For example, pursuant to Section 3, Azure must exercise good faith business judgment in monetizing the licensed patents and report such efforts to Tri-County annually. A1202 § 3.1, A1203 § 3.4. If Tri-County determines that Azure has not exercised good business judgment in monetizing the transferred patents, it can terminate the Agreement and regain all rights conferred to Azure. A1207 § 7.8. Additionally, if at any point Tri-County incurs unwanted tax liabilities as a result of the Agreement, it has the right to unilaterally terminate the Agreement. *Id.* § 7.9. Clauses that provide the licensor with the freedom to terminate if the licensee does not satisfy specific benchmarks indicate that the licensor retains an ownership interest in the patents at issue. *See Propat Int'l Corp.*, 473 F.3d at 1191-92;

Grantham v. McGraw-Edison Co., 444 F.2d 210, 214 (7th Cir. 1971), *overruled-in-part on other grounds by Otis v. City of Chicago*, 29 F.3d 1159 (7th Cir. 1994) (considering, *inter alia*, entitlement to percentage of profits and ability to terminate for failure to exploit patents indicative of an exclusive license); *EMD Crop Bioscience Inc. v. Becker Underwood, Inc.*, 750 F. Supp. 2d 1004, 1017-18 (W.D. Wisc. 2010) (considering "the right to . . . terminate the agreement in the event that EMD Canada fails to use 'commercially reasonable efforts to develop and market' the patents" a substantial right retained by licensor); *Toshiba Corp.*, 270 F.R.D. at 543 (requiring licensee to act in good faith towards licensor's interest in enforcing patents indicates licensor's retention of ownership interests).

Moreover, outside the context of standing, agreements have been held not to transfer all substantial rights in a patent when one party can terminate the agreement. Under 26 C.F.R. § 1.1235-2(b) of the U.S. Treasury regulations, in order for a patent to be transferred for tax purposes, all substantial rights in the patent must be transferred. The regulations instruct and courts have held that the retention of a right to terminate the transfer at will means that there was not a transfer of all substantial rights in the patent. *See id*. § 1.1235-2(b)(4) ("The retention of a right to terminate the transfer at will is the retention of a substantial right. . . ."); *Henry Vogt Mach. Co. v. Comm'r*, No. 21887-90, 1993 WL 315356, at *15 (T.C. Aug. 19, 1993) ("Our decision follows a line of cases which hold that

where a transfer of a patent or technical data is terminable by the grantor not on the happening of a future event beyond his control but at his own discretion before the expiration of a patent . . . the grantor is deemed to have retained substantial rights of value in the technology or patent transferred.") (collecting cases). Similarly, Tri-County's ability to terminate the Agreement at its discretion exemplifies its ongoing ownership interests in the '129 patent.

In addition to Tri-County's ability to unilaterally terminate, the Agreement automatically terminates on March 27, 2018, two years before the patent expires. A1207 § 7.8. Tri-County may, however, extend the Agreement in one-year increments if it desires. *Id.* Agreements that terminate before the patent expires leave the licensor with a substantial reversionary interest in (and ownership of) the patent, regardless of how substantial the licensor's rights otherwise are. *See Aspex Eyewear, Inc. v. Miracle Optics, Inc.*, 434 F.3d 1336, 1342-43 (Fed. Cir. 2006) ("Chic's rights, however substantial in other respects, are unquestionably valid for only for a limited period of time. . . . Contour, absent an amendment of the agreement, will regain all of the rights under the '747 patent that it had previously transferred to Chic. . . . By having rights for only a limited portion of the patent term, it simply did not own the patent."); *Toshiba Corp.*, 270 F.R.D. at 543 (unilateral ability to terminate with sufficient notice prior to renewal date consistent with licensor retaining significant ownership interest); *Resonant Sensors*

Inc., 651 F. Supp. 2d at 572 (licensor's discretionary ability to terminate agreement after two year period was significant retained right).[7]

The district court afforded no weight to Tri-County's reversionary interest because "this renewal provision has no hard termination date—a date beyond which the license cannot be renewed—and could therefore be renewed until the expiration of the '129 Patent, meaning [Tri-County] may never have ownership of the patent again[.]" A0034. This conclusion is flawed.

The district court's holding rests on speculation that Tri-County will decide not once, but twice, to exercise its one-year extension options, thereby pushing the termination date past the expiration of the '129 patent. Rather than relying on unvested future conditions, the district court should have interpreted the Agreement as it stands today, with a termination date of March 2018. Additionally, there is little distinction between (1) an agreement that grants Tri-County alone the ability to renew the contract, which Tri-County later invokes; and (2) an agreement that has a "hard termination date," which Tri-County later renegotiates with Azure to renew. If anything, under the Agreement, Tri-County

[7] *See also Moore U.S.A. Inc. v. Standard Register Co.*, 60 F. Supp. 2d 104, 110-11 (W.D.N.Y. 1999) (holding licensor retained substantial rights in the patent rendering agreement an exclusive license where the agreement terminated before expiration of patent and rights reverted to licensor upon termination); *cf. Commissioner v. Sunnen*, 333 U.S. 591, 609 (1948) (in determining ownership of a patent for tax purposes, a party's ability to unilaterally terminate what is otherwise an assignment indicates that the party "retained a substantial interest in the license contracts which he assigned").

has *greater* rights than it would if there had been a hard termination date because it does not have to negotiate an extension with Azure. Thus, the district court should not have concluded that this provision demonstrated that the Agreement was an assignment. *See IRIS Corp. Berhad v. United States*, 82 Fed. Cl. 488, 496-97 (2008) (agreement constituted exclusive license because the agreement was set to expire seven years prior to patent's expiration and potential extension through patent's life based on speculative acquisition of a government contract insufficient to render it assignment). Indeed, by ignoring the termination date set forth in the Agreement, the district court welcomed the same odd results and policy concerns this Court warned against in *Aspex*—when the Agreement expires in March 2018, Tri-County, who allegedly assigned away all rights in the '129 patent, will regain all rights in the patent and will be able assert the patent against the appellees and others.

Contrary to what the appellees may argue, the discussion of reversionary rights in *Prima Tek II, L.L.C. v. A-Roo Co.*, 222 F.3d 1372 (Fed. Cir. 2000), should not guide this Court's analysis of Tri-County's termination and renewal rights. To be sure, the *Prima Tek II* court stated, without analysis, that an agreement can still be considered to convey all substantial rights even if (1) the grantor can terminate the agreement; or (2) the grantor can extend the agreement past its

termination date. *Id.* at 1378-79. But this discussion in *Prima Tek II* is dicta.[8] The *Prima Tek II* court ultimately held that "the agreement . . . did *not* convey. . . all substantial rights in the patents in suit." *Id.* at 1382 (emphasis added). This holding stemmed not from the analysis of reversionary rights, but from an analysis of rights transferred under the agreement and the conclusion that the full right to exclude was not conveyed. *Id.* at 1379; *see also Sicom Sys.*, 427 F.3d at 977 (stating *Prima Tek II* decision was based on the transfer of rights to exclude, rather than on the reversionary interest discussion). In any event, this Court has disregarded *Prima Tek II*'s language in at least one subsequent case. *See Propat Int'l Corp.*, 473 F.3d at 1191-92 (holding that "[transferor's] power to terminate the agreement and end all of [tranferee's] rights in the patent if [transferee] fails to perform up to the specified benchmarks, although not dispositive, is yet another indication that [transferor] retains a significant ownership interest in the patent"). The Court should do so here as well, and find that Tri-County's reversionary rights demonstrate that the Agreement is not an assignment.

Fourth, Tri-County has a right to 33% of all proceeds resulting from Azure's efforts to obtain any licensing fees, royalties, enforcement proceedings, or other

[8] This dicta also has limited persuasive value. *Prima Tek II* offered no analysis for these two statements. It instead purported to rely on *Vaupel*, and distinguished a contrary result in *Bell* as limited "to the income tax context." *See Prima Tek II*, 222 F.3d at 1379. But the *Vaupel* decision itself rested on *Bell*, rendering the distinction unavailing. *See Vaupel*, 944 F.2d at 874-75.

payments from third parties as a result of the '129 patent. A1202 § 3.1; A1210. This right is consistent with other provisions that preserve Tri-County's ownership rights in the patent while allocating Azure the duty to license and enforce the patents. *See Propat Int'l Corp.*, 473 F.3d at 1191. While Azure has a right to license the patent—as the district court heavily emphasized—Azure's right is "not unfettered, because it [is] liable for annual royalties on the sales of the sublicensees." *Speedplay, Inc. v. Bepop, Inc.*, 211 F.3d 1245, 1251 (Fed. Cir. 2000). Put another way, Azure's ability to sublicense is limited by having to account to Tri-County for revenue on those sublicenses. Again, the district court did not address this factor.

Finally, the Agreement contemplates that Tri-County could join Azure as a party to the suit at Azure's request. *See Abbott Labs*, 47 F.3d at 1132 (finding that Abbott did not have all substantial rights, in part because "the parties appear to have contemplated that Diamedix could participate in a suit brought by Abbott"). The district court discounted Tri-County's participation in suit as simply "regulat[ing] the duties between the licensor and licensee," but held that "a contract cannot change the statutory requirement for suit to be brought by the 'patentee.'" A0033 at n.2 (quoting *Ortho Pharm. Corp. v. Genetics Inst., Inc.*, 52 F.3d 1026, 1034 (Fed. Cir. 1995)). This argument assumes the conclusion. The whole point of looking at the Agreement is to determine *who* is the patentee.

It was error for the district court to assume that the Agreement was an assignment—and that joinder of Tri-County was a contractual issue—in analyzing whether the Agreement is an assignment.

Furthermore, the district court's analysis failed to account for the fact that, under the Agreement, Azure does *not* have unlimited discretion in determining when to bring suit in the first instance. Contrary to the district court's statement that Tri-County "maintains no substantial right to supervise and control Azure's activities with respect to its enforcement," A0034, Azure is bound by the Agreement to bring suit or license as part of its obligation to "exercise good faith business judgment to monetize the Patent(s)." A1202 § 3.1, A1204 § 4.4. If Azure fails to do so, Tri-County may unilaterally terminate the Agreement. A1207 § 7.8. Thus, Azure "does not enjoy the right to indulge infringements, which normally accompanies a complete conveyance of the right to sue." *Abbott Labs.*, 47 F.3d at 1132; *see also E8 Pharms. LLC v. Affymetrix, Inc.*, 680 F. Supp. 2d 292, 297-98 (D. Mass 2010) (finding transferee's obligation to use diligent efforts in identifying and pursuing potential licensees and infringement targets deprived it of unfettered enforcement rights and gave it the status of an agent more than a co-owner). The district court simply got this point wrong.

B. Even If the License Were an Assignment, Tri-County Retains Sufficient Rights To Join Suit with Azure

Even if the Agreement were an assignment (which it is not), Tri-County still would have standing to join suit with Azure. Specifically, if Tri-County "hold[s] exclusionary rights and interests created by the patent statutes," it is entitled to join suit with Azure. *Morrow*, 499 F.3d at 1340; *see also* 8 Donald S. Chisum, *Chisum on Patents* § 21.03[2][a] (2005) ("An assignor may have standing if he retains certain rights in the patent."). That is so because Azure suffers a legally cognizable injury when the defendants infringe the '129 patent, and thus Azure has constitutional standing.[9]

In litigation brought by an exclusive licensee, this Court explained that "the fact that its patent was in jeopardy in the litigation certainly would have affected [the patentee's] interest" such that the patentee "cannot fairly argue that it had no interest in the litigation." *See Evident Corp. v. Church & Dwight Co.*, 399 F.3d 1310, 1314 (Fed. Cir. 2005). Tri-County has interests in the '129 patent that are in jeopardy in this suit. *See supra* pp. 25-34.

[9] There has been no dispute that the other prongs of constitutional standing—a causal connection between the injury and the appellants' infringement and that the harm is redressable—have been met. *See Lujan v. Defenders of Wildlife*, 504 U.S. 555, 560-61 (1992). Additionally, prudential standing constraints have been met because Azure also joined in suit. *See Independent Wireless Tel. Co.*, 269 U.S. at 468-69.

As described above, Tri-County maintains reversionary exclusion rights in the patent that vest at least two years prior to the patent's expiration.[10] When the Agreement is terminated, Tri-County has a right to bring suit for current and past infringement. If the patent is found invalid in this litigation, that right is destroyed. *Cf. Friends of the Earth, Inc. v. Laidlaw Envt'l Servs. (TOC), Inc.*, 528 U.S. 167, 185-86 (2000) (finding standing "for a plaintiff who is injured or faces the threat of future injury due to illegal conduct ongoing at the time of suit").

Also as describe above, Tri-County has a monetary interest: 33% of all proceeds from the '129 patent. A ruling on invalidity in this case will cut off Tri-County's entire revenue stream. *See* Chisum § 21.03[3][b][i] ("'Interest' should include a continuing royalty or a conditional right of reversion or termination."). And a ruling on the appellees' infringement will affect the financial value of the patent and Tri-County's future potential revenue. *See id.* This illustrates Tri-County's exclusionary rights in the patent. Specifically, if the appellees are freely allowed to infringe the '129 patent, Tri-County suffers a direct financial loss. And, Azure has no ability to "indulge an infringement" by the defendants. *Sicom Sys.*, 427 F.3d at 978. If Azure simply ignores the appellee's substantial infringement, then it will have failed to use sound business judgment

[10] Even if reversionary interests in a patent are insufficient to defeat the argument that an agreement is an assignment rather than a license, as suggested by the dicta in *Prima Tek II,* that does not mean that they are not interests in the patent at all.

and Tri-County can terminate the Agreement. *See supra* pp. 27-28. The district court erred by ignoring Tri-County's ultimate control over Azure's enforcement of the exclusive rights of the '129 patent in finding a lack of standing. A0033-35.

The presence of the patent owner (Tri-County) in this litigation also benefits the appellees' interests.[11] It enables them to respond in one action to all claims of infringement and avoid multiple lawsuits. *Independent Wireless Tel. Co.*, 269 U.S. at 468; *Evident*, 399 F.3d at 1314 (factoring the patentee's presence as a factor toward finding standing because it precludes the alleged infringer "from being subject to a separate lawsuit even if it was not liable to [the licensee]."). If Tri-County is not permitted to participate in this case, then the appellees risk being subjected to a second infringement suit on the '129 patent brought by Tri-County after March 27, 2018, when the Agreement terminates. These factors strongly counsel in finding standing here. *See Evident*, 399 F.3d at 1314.

* * *

[11] Indeed, it is puzzling that the appellees advocate the exclusion of a party when it is in their best interest that the party be bound by the judgment; in the majority of cases involving standing issues in the context of exclusive licenses, defendants argue for the inclusion of patentees in suits by exclusive licensees to protect their interests and ensure all issues are resolved in a single suit. *See, e.g.*, *Evident*, 399 F.3d at 1314; *Nilssen v. Universal Lighting Techs., Inc.*, No. 3:04-0080, 2005 WL 1971936, at *6 (M.D. Tenn. Aug. 15, 2005) ("[T]his Court is not aware of any case in which a defendant in a patent-infringement action has sought the dismissal of a possible legal owner of the patents-in-suit, perhaps because it is generally in a defendant's best interest to have joined all possible plaintiffs who might have claims against him arising out of the same alleged infringement."). Here the patent owner joined willingly.

Tri-County is a proper plaintiff in this action and should not have been dismissed.

III. THE DISTRICT COURT IMPROPERLY LIMITED THE TERM "MAC ADDRESS" TO LOCALLY GENERATED ADDRESSES

The term "MAC address" is widely used in network technology to denote the address that uniquely identifies a device or group of devices on a shared communication medium. MAC addresses are defined in IEEE specifications and are used by everything from wireless routers, to smartphones, to Bluetooth headphones. The term carries that well-known meaning not only in industry literature, but in numerous prior art references cited to the examiner during prosecution of the '129 patent. And the network described in the '129 patent uses MAC addresses in the same manner as the prior art—as a unique physical address that identifies a device on the network. The language in other claims further reinforces that understanding. The district court nonetheless required that the MAC address in the patent claims must be "generated by the hub device"—despite the fact that this requirement is found nowhere in the patent, the prior art, or the IEEE specification. The district court's conclusion was based on two errors.

First, the district court mistakenly determined that the patentee acted as a lexicographer to give a special definition to "MAC address," even though the specification contains no express definition of the term. Furthermore, the district court did not identify any statement having "reasonable clarity, deliberateness, and

precision sufficient to narrow the definition of the claim term in the manner urged." *Abbott Labs. v. Syntron Bioresearch, Inc*., 334 F.3d 1343, 1355 (Fed. Cir. 2003). Rather, the district court based its decision entirely on the fact that the patentee expanded "MAC address" as "Media Access address" rather than "Media Access Control address."

Second, finding no express redefinition of MAC address, the district court cobbled one together by considering how MAC addresses were used in several exemplary embodiments in the specification. The result is that the district court improperly imported limitations from the specification's preferred embodiments to require that the MAC address must be "generated by the hub device." *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1323 (Fed. Cir. 2005) ("[A]lthough the specification often describes very specific embodiments of the invention, we have repeatedly warned against confining the claims to those embodiments"). In doing so, the district court excluded the most prevalent form of MAC addresses in the electronic industry—universal MAC addresses that are assigned to a device at the time of manufacture. This restriction is particularly problematic because the prior art acknowledges that the '129 patent and the IEEE's standards for wireless networks that use MAC addresses have *a common source*: BBN's BodyLAN project. A5786.

A. The Ordinary Meaning of "MAC Address" Includes Locally and Universally Assigned Addresses

MAC addresses are used throughout wireline and wireless networks to denote a particular way to uniquely identify the physical devices on the network. The term "MAC address" was coined by Xerox during early work on networking and has been defined in specifications put forth by the IEEE ever since. *See* A1604-07; *see also Seachange Int'l, Inc. v. C-COR Inc.*, 413 F.3d 1361, 1376-77 (Fed. Cir. 2005) (referencing the district court's appropriate use of an IEEE publication to discern the ordinary meaning of a term). IEEE documents created around the priority date of the '129 patent describe MAC addresses as a set of numbers that uniquely identify a physical network device. A1604. The most common form of MAC address at the time was a string of 48 bits. *Id.* The IEEE envisioned that the MAC address would be transmitted to provide routing information for packets of data going through the network to specify the destination for each packet. A1608.

Critically, the IEEE provided that MAC addresses could be assigned to a network device either universally at the time of the device's manufacture or locally by the network. Within the first portion of the 48-bit address there is a "Universally or Locally administered (U/L) address bit . . . [which] indicates whether the address has been assigned by a local or universal administrator;" if the bit is set to zero, it is universally administered; if the bit is set to 1, "the entire

address (i.e., 48 bits) has been locally administered." A1605. The intrinsic evidence comports with this understanding of the term "MAC address."

First, the prior art cited on face of the '129 patent uses MAC addresses in a manner entirely consistent with the IEEE specification. *See Phillips*, 415 F.3d at 1317 ("the 'intrinsic evidence,' consists of the complete record of the proceedings before the PTO and includes the prior art cited during the examination of the patent") (citation omitted). Specifically, the prior art discloses that MAC addresses may be used as unique addresses to identify the specific physical network device and that the MAC address would be found in the routing information for packets of data traveling through the network. *See*, *e.g.*, A7450 (WO 00/68811 publication 5:7-10) ("In an Ethernet environment, address information in the header reflects a media access control (MAC) hardware address, which is an absolute value and not readily mapped to a user or host, which have a logical rather than physical address."); A3455 (U.S. Patent No. 6,115,390 14:24-29 ("the '390 patent")) ("The frame body [] is followed by a frame check sequence [] and preceded by a MAC header [] comprised of a one-byte frame control (FC) field [], a 2-byte frame duration field [], a 6-byte source MAC address [], a 6-byte destination MAC address [], and a 2-byte sequence control field [].").

Additionally, the cited prior art makes clear that the MAC address can be universal and pre-assigned or it can be temporary and defined by the local network.

For example, U.S. Patent No. 6,570,857 ("the '857 patent") describes the process of a hub device (the "master") providing temporary MAC addresses to other devices (the "slaves"): "When a parked slave wants to become active, it indicates this to the master, at which time the master allocates this slave a free, temporary MAC address." A3916 ('857 patent 4:30-35); A3918 ('857 patent 7:54-58) ("A slave that can be put inactive for a longer amount of time will enter the PARK mode. In this mode, a slave gives up the MAC address [], thereby making the MAC address [] available for assignment to another slave unit."). This prior art specifically refers to the IEEE specification for MAC addresses, making clear that this is not a unique definition of MAC addresses. *See* A3915 ('857 patent 2:5-7). U.S. Patent No. 6,574,266 ("the '266 patent") describes a similar temporary MAC address assigned to slave devices. *See* A3935 ('266 patent 10:39-44); *compare* A7450 (WO 00/68811 publication 5:7-10) (discussing MAC address with an absolute value for that hardware).

The '129 patent's specification also uses MAC addresses for the same purpose and in the same manner as the prior art. The '129 patent uses MAC addresses to uniquely identify each device in the network. *See* A0137 ('129 patent 3:60-62) ("The Hub [] uses MAC address to identify itself and the PEAs []."). The MAC address is included in the routing information for the data. *See* A0140 ('129 patent 9:1-10) (PEAs disregarding data if destined for a different MAC

address). This is done to allow the hub and PEAs to communicate over the network. *See* A0137 ('129 patent 3:64-66) ("The Hub [] combines a MAC address and a stream number into a token, which it broadcasts to the PEAs [] to control communication through the network [].") In the examples provided in the specification, the hub selects the MAC address, which is one of the two possibilities contemplated by the IEEE specification. *See* A0141 ('129 patent 11:3-4).

This correlation between the use of MAC addresses in the '129 patent and the IEEE definition is no accident. A prior art document cited by the '129 patent describes the development of the BBN BodyLAN project which resulted in the invention disclosed in the patent. A5786. This 2006 IEEE Workshop document notes that the BodyLAN was "a development that paved the way for today's IEEE 802.15." *Id*. This same IEEE 802.15 working group promulgated standards for wireless networks based on the IEEE 802 specification, which defines MAC addresses as both dynamically and universally assigned. A1605. It is difficult to imagine better evidence that the MAC addresses commonly used in wireless networks and embodied in the IEEE specification are the same as those discussed in the '129 patent, given that they had common roots.

Finally, the claims' use of "MAC address" comports with the standard industry definition. *See Phillips*, 415 F.3d at 1314 ("Other claims of the patent in

question, both asserted and unasserted, can also be valuable sources of enlightenment as to the meaning of a claim term.") (citation omitted). The claims describe using MAC addresses to uniquely identify peripheral devices. *See*, *e.g.*, A0142 ('129 patent claim 2) ("The method according to claim 1, wherein the first peripheral device identifier is based at least in part on a MAC address of the first peripheral device."); A0143 ('129 patent claim 43) ("wherein the hub device is configured such that a plurality of MAC addresses is capable of being used for identification in association with the first peripheral device"). Additionally, some claims specifically describe that the MAC addresses are assigned by the local network. *See*, *e.g.*, *id.* ('129 patent claim 50) ("The hub device according to claim 48, wherein the link layer is responsible for assignment of the plurality of MAC addresses."). But other claims—including those at issue in this case—do not specify how the MAC addresses are generated in the first instance. For example, claim 2 states that "the first peripheral device identifier is based at least in part on a MAC address of the first peripheral device," without specifying the source of the MAC address. A0142 ('129 patent claim 2). The inclusion of the requirement that the MAC address is locally assigned in some claims and its omission in others suggests that MAC address has its standard definition—it encompasses both universal and locally generated addresses. *See Saunders Grp., Inc. v. Comfortrac, Inc.*, 492 F.3d 1326, 1336 (Fed. Cir. 2007) ("the inclusion of the 'pressure

activated seal' limitation in some claims and its omission from others, is a sufficiently powerful indicator" that the claim term encompassed devices without pressure active seals).

B. The Patentee Did Not Redefine the Technical Term "MAC Address"

Despite the intrinsic evidence, the district court held that the patentee redefined the term MAC address. The district court's sole reason for finding that the patentee "acted as his own lexicographer," A0010, is because the '129 patent states that, for the hub and PEAs, "[e]ach device is identified by a Media Access (MAC) address." A0137 ('129 patent 3:31-32). In the prior art and industry references, the acronym "MAC" is normally expanded to either "Media Access Control" or "Medium Access Control." *See* A2776 (U.S. Patent No. 5,371,734 1:24 ("the '734 patent")) and A2781 ('734 patent 11:23-24) (using both expansions for MAC); A1963 (same); A7450 (WO 00/68811 publication 5:7-13) (expanding to "media access control"); A3454 ('390 patent 11:34) (expanding to "medium access control").[12] Because the '129 patent, in a single instance, expands the acronym as "Media Access address," the district court held that the '129 patent had

[12] Other technical literature expands "MAC address" as "Media Access address," as found in the '129 patent. *See*, *e.g.*, A1974 (describing a NIC's 48-bit address as "its own media access address (MAC)"); A1978 (stating that "MAC Address prioritizes network devices by their Media Access Address (MAC address)").

therefore entirely redefined the term simply by dropping one word (control) when expanding out the acronym.

But to redefine a term of art having an established meaning, the patentee must set forth a definition "with reasonable clarity, deliberateness, and precision" in the specification. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). To that end, any redefinition must be sufficiently clear to put a reasonable competitor on notice that the patentee intends to depart from a term's ordinary meaning. *See Merck & Co. v. Teva Pharms. USA, Inc.*, 395 F.3d 1364, 1370 (Fed. Cir. 2005); *Mycogen Plant Sci. v. Monsanto Co.*, 243 F.3d 1316, 1327 (Fed. Cir. 2001) ("[A] patentee is free to be his own lexicographer, so long as the special definition of a term is made explicit in the patent specification or file history.").

But here, the patentee did not provide *any* definition of MAC address. Put another way, the patentee never announced what MAC address means. The reason is clear. He was simply using the definition of MAC address that was employed by people in his field. In any event, when a patent does not contain any definition of a term, it is difficult to see how the patentee could have redefined the term with "clarity, deliberateness, and precision."

The appellees may argue that the unorthodox expansion of MAC address signaled that the patentee intended an "implied" redefinition of the term. But this argument fails as well. An "'implied' redefinition must be so clear that it equates

to an explicit one." *Thorner v. Sony Computer Entm't Am. LLC*, 669 F.3d 1362, 1368 (Fed. Cir. 2012). Thus, this Court has only found implicit redefinitions where, for example, the patentee stated in the "Description of the Invention" that a term was "defined below" and then used the term in examples, *Astrazeneca AB v. Mut. Pharm. Co.*, 384 F.3d 1333, 1339-40 (Fed. Cir. 2004), or where the patentee expressly makes a description of a term "applicable to 'all embodiments of the present invention,'" *SciMed Life Sys., Inc. v. Advanced Cardiovascular Sys., Inc.*, 242 F.3d 1337, 1344 (Fed. Cir. 2001). There is no such clear statement in the '129 patent. On the contrary, the patentee makes no statement about the definition of "MAC address," and the specification continually emphasizes that it is disclosing only "exemplary" embodiments. *See, e.g.*, A0138 ('129 patent 5:9-12, 30-34) (describing MAC addresses in an "exemplary diagram of a software architecture").

The mere fact that the patentee dropped the word "control" when expanding the acronym does not demonstrate a redefinition of the term. Here, the '129 patent uses MAC address in the same way as the cited prior art and the IEEE specification, suggesting that the MAC addresses in the '129 patent are the MAC addresses used throughout the field. The fact that the inventor dropped a word in expanding "MAC address" at one point in the specification does not suggest a redefinition of the term.

Finally, the appellees previously argued that the patentee's use of Media Access rather than Media Access Control is significant because the patentee used the term contrary to how it was customarily used in the art—as an address that can only be assigned to a device at the time of manufacture. First, this is factually inaccurate. As described above, people in the art appreciate that MAC addresses can be universal or locally defined. Moreover, the appellee's argument is logically flawed. The appellees argue that the term "MAC address" should be limited by the embodiments in the specification because the patentee specially redefined the term MAC addresses. It is circular to argue that the patentee redefined the term MAC address due to the use of those MAC addresses in the embodiments.

C. The District Court Erred by Importing a Limitation from the Specification

Having incorrectly held that the patentee redefined the term "MAC address," the district court compounded its error by drawing a new definition for that term from the MAC addresses described in specific embodiments. Because the exemplary embodiments all use a locally defined MAC address, the district construed the term to require that the addresses be "generated by the hub." A0011.

As an initial matter, the district court erred "simply by pointing to the preferred embodiment or other structures or steps disclosed in the specification or prosecution history" to support a specialized meaning of "MAC address." *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002); *see also*

Thorner, 669 F.3d 1362 at 1368 (giving a term its ordinary meaning because "disclosing embodiments that all use the term the same way is not sufficient to redefine a claim term"); *Laryngeal Mask Co. v. Ambu*, 618 F.3d 1367, 1372 (Fed. Cir. 2010) (refusing to give special definition to a term because "[a]lthough the preferred embodiment includes a backplate that contains a tube joint, we do not generally limit claims to the preferred embodiment").

While the district court couched its decision as determining the patentee's special definition for the term "MAC addresses," it was doing nothing more than committing "one of the cardinal sins of patent law—reading a limitation from the written description into the claims." *SciMed Life Sys.*, 242 F.3d at 1340. This is clear because each citation that the district court relied on is described as "another implementation" or an "exemplary embodiment." *Compare* A0010 (relying on '129 patent 11:2-3; 11:55-57; 12:22-24) *with* A0140 ('129 patent 10:43-12:39) (section entitled "Exemplary Attachment Processing"); *compare* A0011 (relying on '129 patent 1:64-67; 2:2-3) *with* A0136 ('129 patent 1:62-2:6) (describing the method contained in the paragraph as "another implementation consistent with the present invention"). Properly understood, these statements merely describe specific examples and implementations of the invention rather than the invention itself. *See C.R. Bard, Inc. v. United States Surgical Corp.*, 388 F.3d 858, 864 (Fed. Cir. 2004) ("Statements that describe the invention as a whole, rather than

statements that describe only preferred embodiments, are more likely to support a limiting definition of a claim term."). Indeed, this is clear because the '129 patent nowhere describes *how* the hub generates MAC addresses. If a key feature of the invention were the generation of uniquely defined MAC addresses—as the appellees maintain—it would seem likely that the specification would have actually described it. *See Innova/Pure Water, Inc. v. Safari Water Filtration Sys.*, 381 F.3d 1111, 1117 (Fed. Cir. 2004) ("[E]ven where a patent describes only a single embodiment, claims will not be read restrictively unless the patentee has demonstrated a clear intention to limit the claim scope. . . .") (internal quotation marks and citation omitted). Nor does the patent specification ever state—much less emphasize—that universal MAC addresses cannot be used. *See Alloc, Inc. v. Int'l Trade Comm'n*, 342 F.3d 1361, 1370 (Fed. Cir. 2003) (considering whether "the very character of the invention" requires the limitation to be read into the claims).

* * *

In sum, the term "MAC address" has a well-understood meaning in the art that is entirely consistent with the intrinsic evidence in '129 patent. The district court should not redefine the term, and it certainly should not have done so based on exemplary embodiments.

CONCLUSION

This Court should reverse the district court's order dismissing Tri-County and vacate the judgment of non-infringement based on the district court's erroneous construction of the claim term "MAC address."

Respectfully submitted,

/s/ Michael E. Joffre

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August 20, 2013

Counsel for Plaintiffs-Appellants Azure Networks, LLC and Tri-County Excelsior Foundation

ADDENDUM

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IN THE UNITED STATES DISTRICT COURT

FOR THE EASTERN DISTRICT OF TEXAS

TYLER DIVISION

AZURE NETWORKS, LLC, et al.	§	
	§	
Plaintiffs,	§	**Civil Action No. 6:11-CV-139-LED-JDL**
	§	
v.	§	
	§	**JURY TRIAL DEMANDED**
CSR PLC, et al.,	§	
	§	
***Defendants*.**	§	

FINAL JUDGMENT

Based upon this Court's construction of the term "MAC address(es)" in United States Patent No. 7,756,129 ("the '129 Patent"), pursuant to the Order dated January 15, 2013 and this Court's Order adopting same, the parties have stipulated that, under this Court's construction, none of the Defendants' accused products satisfy the "MAC address(es)" limitation of the asserted claims, and all Defendants are entitled to a judgment of non-infringement as a matter of law as to all of Plaintiffs' asserted claims.[1] Accordingly, the Court enters Judgment as follows:

Judgment is entered against Plaintiffs and for Defendants as to Plaintiffs' claims for patent infringement, subject to the parties' right to appeal;

Subject to the parties' right to appeal, the Court further enters judgment for Defendants and against Plaintiffs on Defendants' counterclaims seeking declaratory judgment of non-infringement and Defendants' affirmative defenses of non-infringement, and declares the '129 Patent not infringed by Defendants. Plaintiffs Azure Networks, LLC and Tri-County Excelsior

[1] Defendants' "accused products" include the products identified in Plaintiffs' Infringement Contentions served December 15, 2011 and the products identified by Defendants in response to Plaintiffs' Interrogatory No. 1 as of January 1, 2013.

Foundation shall take nothing from Defendants with respect to the asserted claims of the '129 Patent;

All other claims, counterclaims, defenses, or other matters which have been asserted, including Defendants' counterclaims of patent invalidity, are dismissed without prejudice;

All pending motions are denied, all pending objections to any report and recommendation of the Magistrate Judge are overruled, and those reports and recommendations are adopted as the Orders of the Court;

Each party shall bear its own costs and attorneys' fees.

It is SO ORDERED.

SIGNED this 30th day of May, 2013.

MICHAEL H. SCHNEIDER
UNITED STATES DISTRICT JUDGE

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
TYLER DIVISION

AZURE NETWORKS, LLC et al.,	§	
	§	**NO. 6:11cv139 LED-JDL**
vs.	§	
	§	**PATENT CASE**
CSR PLC, et al.	§	

MEMORANDUM OPINON AND ORDER

This claim construction opinion construes the disputed terms in U.S. Patent No. 7,756,129 ("the '129 Patent"). For the reasons stated herein, the Court adopts the constructions set forth below.

BACKGROUND

Plaintiffs Azure Networks LLC and TRI-County Excelsior Foundation (collectively "Plaintiffs") allege Defendants[1] infringe the '129 Patent ("patent-in-suit"). The parties have presented extensive claim construction briefing (Doc. Nos. 237, 249, 253).

On October 16, 2012, Plaintiffs filed their opening claim construction brief in this case (Doc. No. 237). ("PLS.' BR."). Defendants collectively filed a single response (Doc. No. 249) ("DEFS.' BR."), and Plaintiffs filed a Reply (Doc. No. 253) ("REPLY").

CLAIM CONSTRUCTION PRINCIPLES

"It is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude.'" *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1115 (Fed. Cir. 2004)). The Court examines a patent's intrinsic evidence to define

[1] Defendants are CSR plc, Cambridge Silicon Radio International LLC, Atheros Communications, Inc., Broadcom Corporation, Marvell Semiconductor, Inc., Qualcomm Incorporated, Ralink Technology Corporation (Taiwan), Ralink Technology Corporation (USA), and Texas Instruments, Inc. (collectively "Defendants").

the patented invention's scope. *Id.* at 1313–14; *Bell Atl. Network Servs., Inc. v. Covad Commc'ns Group, Inc.*, 262 F.3d 1258, 1267 (Fed. Cir. 2001). Intrinsic evidence includes the claims, the rest of the specification and the prosecution history. *Phillips*, 415 F.3d at 1312–13; *Bell Atl. Network Servs.*, 262 F.3d at 1267. The Court gives claim terms their ordinary and customary meaning as understood by one of ordinary skill in the art at the time of the invention. *Phillips*, 415 F.3d at 1312–13; *Alloc, Inc. v. Int'l Trade Comm'n*, 342 F.3d 1361, 1368 (Fed. Cir. 2003).

Claim language guides the Court's construction of claim terms. *Phillips*, 415 F.3d at 1314. "[T]he context in which a term is used in the asserted claim can be highly instructive." *Id.* Other claims, asserted and unasserted, can provide additional instruction because "terms are normally used consistently throughout the patent." *Id.* Differences among claims, such as additional limitations in dependent claims, can provide further guidance. *Id.*

"[C]laims 'must be read in view of the specification, of which they are a part.'" *Id.* (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995)). "[T]he specification 'is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.'" *Id.* (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)); *Teleflex. Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1325 (Fed. Cir. 2002). In the specification, a patentee may define his own terms, give a claim term a different meaning that it would otherwise possess, or disclaim or disavow some claim scope. *Phillips*, 415 F.3d at 1316. Although the Court generally presumes terms possess their ordinary meaning, this presumption can be overcome by statements of clear disclaimer. *See SciMed Life Sys., Inc. v. Advanced Cardiovascular Sys., Inc.*, 242 F.3d 1337, 1343-44 (Fed. Cir. 2001). This presumption does not arise when the patentee acts as his own

lexicographer. *See Irdeto Access, Inc. v. EchoStar Satellite Corp.*, 383 F.3d 1295, 1301 (Fed. Cir. 2004).

The specification may also resolve ambiguous claim terms "where the ordinary and accustomed meaning of the words used in the claims lack sufficient clarity to permit the scope of the claim to be ascertained from the words alone." *Teleflex, Inc.*, 299 F.3d at 1325. For example, "[a] claim interpretation that excludes a preferred embodiment from the scope of the claim 'is rarely, if ever, correct.'" *Globetrotter Software, Inc. v. Elam Computer Group Inc.*, 362 F.3d 1367, 1381 (Fed. Cir. 2004) (quoting *Vitronics Corp.*, 90 F.3d at 1583). But, "[a]lthough the specification may aid the court in interpreting the meaning of disputed language in the claims, particular embodiments and examples appearing in the specification will not generally be read into the claims." *Constant v. Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 1571 (Fed. Cir. 1988); *see also Phillips*, 415 F.3d at 1323.

The prosecution history is another tool to supply the proper context for claim construction because a patentee may define a term during prosecution of the patent. *Home Diagnostics Inc. v. LifeScan, Inc.*, 381 F.3d 1352, 1356 (Fed. Cir. 2004) ("As in the case of the specification, a patent applicant may define a term in prosecuting a patent"). The well-established doctrine of prosecution disclaimer "preclud[es] patentees from recapturing through claim interpretation specific meanings disclaimed during prosecution." *Omega Eng'g Inc. v. Raytek Corp.*, 334 F.3d 1314, 1323 (Fed. Cir. 2003). The prosecution history must show that the patentee clearly and unambiguously disclaimed or disavowed the proposed interpretation during prosecution to obtain claim allowance. *Middleton Inc. v. 3M Co.*, 311 F.3d 1384, 1388 (Fed. Cir. 2002); *see also Springs Window Fashions LP v. Novo Indus., LP*, 323 F.3d 989, 994 (Fed. Cir. 2003) ("The disclaimer . . . must be effected with 'reasonable clarity and deliberateness.'")

(citations omitted). "Indeed, by distinguishing the claimed invention over the prior art, an applicant is indicating what the claims do not cover." *Spectrum Int'l v. Sterilite Corp.*, 164 F.3d 1372, 1378–79 (Fed. Cir. 1988) (quotation omitted). "As a basic principle of claim interpretation, prosecution disclaimer promotes the public notice function of the intrinsic evidence and protects the public's reliance on definitive statements made during prosecution." *Omega Eng'g, Inc.*, 334 F.3d at 1324.

Although, "less significant than the intrinsic record in determining the legally operative meaning of claim language," the Court may rely on extrinsic evidence to "shed useful light on the relevant art." *Phillips*, 415 F.3d at 1317 (quotation omitted). Technical dictionaries and treatises may help the Court understand the underlying technology and the manner in which one skilled in the art might use claim terms, but such sources may also provide overly broad definitions or may not be indicative of how terms are used in the patent. *Id.* at 1318. Similarly, expert testimony may aid the Court in determining the particular meaning of a term in the pertinent field, but "conclusory, unsupported assertions by experts as to the definition of a claim term are not useful." *Id.* Generally, extrinsic evidence is "less reliable than the patent and its prosecution history in determining how to read claim terms." *Id.*

DISCUSSION

A. Overviews of the Patent-in-Suit

The '129 Patent is titled "Personal Area Network with Automatic Attachment and Detachment" and relates to wireless communication between two or more devices located in close proximity to one another. More specifically, the '129 Patent relates to wireless communication between a processor unit and multiple peripherals. The '129 Patent discloses a Personal Area Network ("PAN"), which is managed by a hub device and can support wireless

"attachment" of multiple Personal Electronic Accessories ("PEAs"). '129 Patent at 3:10–32. The PAN is diagrammed in Figure 1:

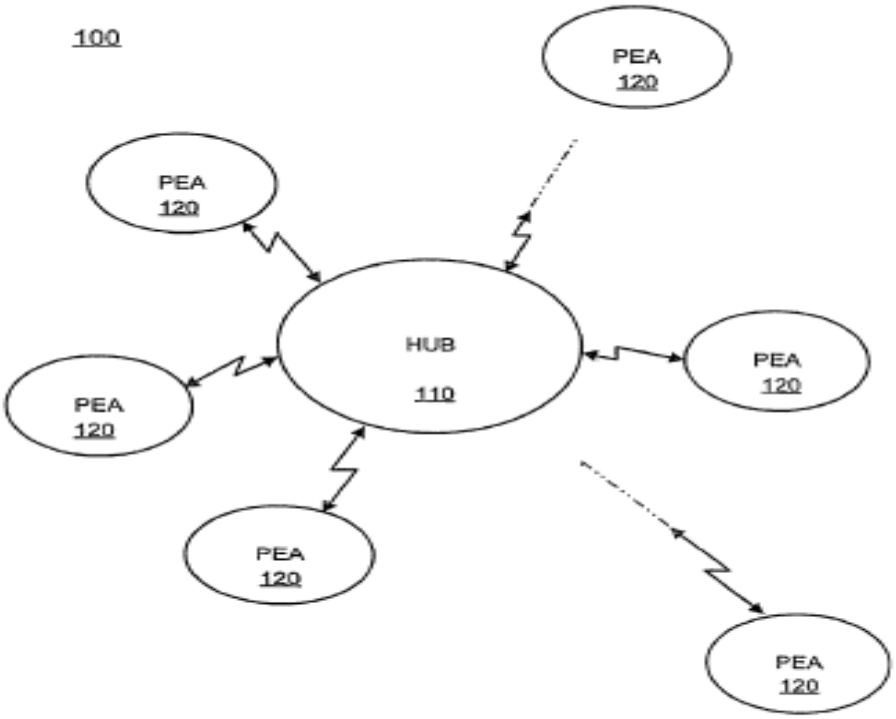

FIG. 1

The PAN 100, as shown in Figure 1, contains a single hub device (110), located in the center of the diagram, and surrounded by multiple PEAs (120). *Id.* at 3:27–29.

Plaintiffs accuse Defendants of infringing claims 43, 45–49, 51–53, 55, 57–59, 61, 63–64, 75, 79, 81, 95, 111, 124–129, 132, 134, 137, 140, 145–148, and 156, all of which depend from Claim 14 and which are referred to by the parties as "hub device claims." PLS.' BR. at 4–5. Plaintiffs also accuse Defendants of infringing claims 221, 223–227, 229, 233, 236–237, 257,

259, 262–263, 302–304, 306, 311, 323, 334, all of which depend from Claim 27 and which are referred to by the parties as the "peripheral device claims." *Id.* at 5.

B. Disputed Terms

Claim Language	Plaintiff's Proposal	Defendants' Proposal	Court's Construction
1. "MAC address"			
129: 43, 221	"an address that uniquely identifies a device or group of devices on a shared communication medium"	"a device identifier created by the hub device"	"a device identifier generated by the hub device"

Plaintiffs rely on the claims to support their proposed construction, citing Claims 43 and 221 as examples:

> 43. The hub device according to claim 14, wherein the hub device is configured such that a plurality of MAC addresses is capable of being used for identification in association with the first peripheral device. ('129 Patent at 16:41–44).
>
> 221. The peripheral device according to claim 27, wherein the peripheral device is configured such that a plurality of MAC addresses is capable of being used for identification in association therewith. ('129 Patent at 26:26–29).

PLS.' BR. at 10.

Plaintiffs contend that the '129 Patent discloses a MAC address consistent with the ordinary meaning of MAC address as understood by one of ordinary skill in the art. Plaintiffs cite the rules and conventions of the Institute of Electrical and Electronic Engineers ("IEEE") as well as dictionary definitions to support their proposition that a MAC address uniquely identifies a device or group of devices. *See, e.g.*, PLS.' BR. at 11, citing IEEE COMPUTER SOCIETY, IEEE STANDARD FOR LOCAL AND METROPOLITAN AREA NETWORKS: OVERVIEW AND ARCHITECTURE 20–23 (2001); FRANK HARGRAVE, HARGRAVE'S COMMC'NS DICTIONARY at 313 (IEEE Press

2001) (defining MAC address as: "a 48 bit number unique to each network interface card (NIC). Generally, the number is programmed into the NIC at the time of manufacture; hence, it is LAN and location independent."); HARRY NEWTON, NEWTON'S TELECOM DICTIONARY 450 (CMP Books 2002) (discussing a MAC address as: "in the form of a 48-bit number, formally known as an EUI-48 (Extended Unique Identifier-48), which is unique to each LAN (Local Area Network)"). Plaintiffs argue that this ordinary meaning is consistent with the disclosure of the '129 Patent, whereby MAC addresses can be both universally administered addresses or locally administered addresses. PLS.' BR. at 11–12.

Defendants argue that the term "MAC address," as used in the '129 Patent, has a meaning other than the ordinary meaning argued by Plaintiffs. DEFS.' BR. at 4. Specifically, Defendants point out that MAC address is defined as "Media Access address" in the '129 Patent, which is different than the customary "Medium Access Control address." *Id.* Defendants similarly point to the inventor's own documents which refer to MAC as "Media Access," not "Medium Access Control," suggesting the inventor acted as his own lexicographer in defining the term "MAC address." *Id.* at 5. In this regard, Defendants assert that the only embodiment disclosed by the '129 Patent shows the hub device creating and assigning the MACs. *Id.* at 10. (the hub "assigns a MAC address to the PEA") '129 Patent at 11:2–4. Therefore, Defendants argue that Plaintiffs' proposed construction encompasses a network not disclosed by the '129 Patent or contemplated by the patentee. DEFS.' BR. at 10–11.

On the lexicography issue, Plaintiffs reply that there is not a clear intent by the patentee to change the intended meaning of "MAC address" evidenced in the '129 Patent. REPLY at 1. Further, Plaintiffs contend the patentee's use of "Media Access" is insignificant because it is merely the plural form of the singular noun "Medium." *Id.* Plaintiffs also contend that

Defendants' construction excessively complicates an infringement analysis because one would be required to determine (1) whether an address was created by a particular device; and (2) whether that device was a hub device. PLS.' BR. at 13. Finally, Plaintiffs argue that Defendants' construction, which requires creation by the hub device, would exclude dependent claims involving "self-selected MAC addresses (AMACs)" and "attach MAC (AMAC) addresses" used during peripheral device attachment. REPLY at 3; '129 Patent at 7:61-62; 10:50-51.

Turning first to whether the patentee acted as his own lexicographer, the '129 Patent suggests that the patentee did in fact define MAC address in his own unique way. "When a patentee acts as his own lexicographer in redefining the meaning of particular claim terms away from their ordinary meaning, he must clearly express that intent in the written description…the statement in the specification must have sufficient clarity to put one reasonably skilled in the art on notice that the inventor intended to redefine the claim term." *Merck & Co. v. Teva Pharms. USA, Inc.*, 395 F.3d 1364, 1370 (Fed. Cir. 2005) (citations omitted). "The specification acts as a dictionary 'when it expressly defines terms used in the claims or when it defines terms by implication.'" *Bell Atl. Network Servs., Inc.*, 262 F.3d at 1268 (quoting *Vitronics Corp.*, 90 F.3d at 1582).

Here, in the specification, the patentee expressly defined MAC address as "Media Access address" ("[e]ach device is identified by a Media Access (MAC) address"). '129 Patent 3:31–32. The specification then goes on to consistently discuss the generation and assignment of the MAC address by the hub device. ("The Hub 110 then assigns a MAC address to the PEA address…" 11:2–3; "the Hub 110 sends the new MAC address 610 in an attachment assignment message to the now-identified PEA…" 11:55–57; "[t]he unattached PEA 120 then waits for an attach-assignment with an assigned MAC address from the Hub 110" 12:22–24; "a hub device

connected to multiple peripheral devices, includes receiving an attach request from the unattached peripheral device, the attach request identifying the unattached peripheral device to the hub device; *generating a new address* to identify the unattached peripheral device in response to the received attach request" 1:64–67, 2:1–2 (emphasis added)). As is the case here, "terms coined by the inventor are best understood by reference to the specification." *Bell Atl. Network Servs., Inc.*, 262 F.3d at 1271. The specification of the '129 Patent consistently describes a MAC address assigned and generated by the hub device in accordance with the disclosed invention, a PAN wherein all communication is orchestrated by the Hub. Therefore, the Court finds that the patentee did coin a new term, which should be construed in light of its express and consistent use in the specification. *Intervet Inc. v. Merial Ltd.*, 617 F.3d 1282, 1287 (Fed. Cir. 2010) (noting that "terms coined by the inventor are best understood by reference to the specification").

The core of the parties' dispute comes down to whether the "MAC address" must be created by the hub device. Plaintiffs argue that the self-selection of MAC addresses by the PEAs disclosed in the '129 Patent supports their position that "MAC address" has its plain and ordinary meaning, and regardless, has a meaning broader than Defendants' suggestion that it be created only by the hub device. Specifically, Plaintiffs point to the following portion of the specification: "[e]ach attaching PEA 120 selects a new AMAC at random from the indicated range when it hears the heartbeat." '129 Patent at 11:30–31. While the PEA selects a new AMAC at random, the specification goes on to disclose that it is the hub device that creates the "range" of addresses from which the PEA selects. ("the Hub 110 occasionally indicates a large AMAC range" 11:33–34; "the Hub 110 may select a small range of AMACs" 11:37–38). Thus, although self-selection does occur, it occurs only among what is made available by the hub

device. Plaintiffs argue that a construction including the creation of the MAC address by the hub device would conflict with the disclosure of self-selecting peripheral devices. The specification makes it clear, however, that no such conflict exists. Similarly, the fact that the specification also states that the hub device has its own MAC address does not present any conflict with the MAC address being generated or assigned by the hub device. Therefore, the Court finds the purported conflict presented by Plaintiffs unpersuasive.

Finally, Plaintiffs make claim differentiation arguments to support their proposal that MAC address has a broader meaning. Plaintiffs point to Claim 14 to show that what is being claimed in step (iii) includes a "first peripheral device identifier," an identifier that is not a MAC address. Plaintiffs then contrast Claim 14 with its dependent Claim 43, where the named identifier is a MAC address. Plaintiffs contend that an identifier is therefore broader than MAC address, and accordingly, MAC address should be construed more broadly because the patentee is signaling that the claims should not be limited through his use of multiple identifiers. While such an argument may support a broader interpretation of the "first peripheral identifier," it does not follow that therefore the meaning of MAC address in the dependent claim should also be interpreted more broadly. Plaintiffs' claim differentiation argument as to Claim 50 should also be rejected. Claim 50, which depends from Claim 43, simply requires that the link layer, in particular, is responsible for the assignment of the plurality of MAC addresses. Finally, "claim differentiation is a rule of thumb that does not trump the clear import of the specification." *Edwards Lifesciences LLC v. Cook Inc.*, 582 F.3d 1322, 1331 (Fed. Cir. 2009).

The Court therefore construes "MAC address" as "a device identifier generated by the hub device."

Claim Language	Plaintiff's Proposal	Defendants' Proposal	Court's Construction
2. **"capable of being used for identification in association with the first peripheral device"** **"capable of being used for identification in association therewith"**			
129: 43, 221	No construction necessary Alternatively: "[T]he phrase 'capable of being used for identification in association with the first peripheral device' is understood to mean 'capable of being used by the hub device to distinguish the first peripheral device from other devices.'" "Likewise, . . . the phrase 'capable of being used for identification in association therewith' is readily understood to mean 'capable of being used to distinguish the peripheral device from other devices.'"	Indefinite, or alternatively, "capable of being used as the first peripheral device identifier / capable of being used as the peripheral device identifier"	"capable of being used to distinguish the first peripheral device from other devices" "capable of being used to distinguish the peripheral device from other devices"

The "capable of" phrases in dispute are found in Claims 43 and 221 of the '129 Patent, and read as follows:

> 43. The hub device according to claim 14, wherein the hub device is configured such that a plurality of MAC addresses is capable of being used for identification in association with the first peripheral device. ('129 Patent at 16:41–44).
>
> 221. The peripheral device according to claim 27, wherein the peripheral device is configured such that a plurality of MAC addresses is capable of being used for identification in association therewith. ('129 Patent at 26:26–29).

In their briefing, Plaintiffs proposed no construction necessary on the basis that the "capable of" phrases are easily understood because they use commonly understood words and phrases. PLS.' BR. at 24. Alternatively, Plaintiffs proposed the phrases be construed as: "capable of being used by the hub device to distinguish the first peripheral device from other devices;" and "capable of being used to distinguish the peripheral device from other devices." *Id.* at 25. At the *Markman* hearing on December 20, 2012, the Court proposed the following constructions: "capable of being used by the hub device to distinguish the first peripheral device from other devices;" and "capable of being used to distinguish the peripheral device from other devices." Based on the Court's proposed constructions, Plaintiffs suggested the Court adopt its proposed constructions with the insertion "or subcomponents thereof" after "peripheral device."

Defendants maintained that the "capable of" phrases are indefinite and filed a corresponding Motion for Summary Judgment on Invalidity for Indefiniteness (Doc. No. 248). In the alternative, Defendants proposed the Court construe the terms as "capable of being used as the first peripheral device identifier;" and "capable of being used as the peripheral device identifier." DEFS.' BR. at 22.

The parties agree as to the basic contours of a construction for the "capable of" phrases. Both parties agree that a MAC address is a device identifier and when used in the context of Claim 43, which depends from Claim 14, it identifies the first peripheral device. DEFS.' BR. at

43; PLS.' BR. at 25–26; REPLY at 9. The parties' dispute lies with whether the construction should include the term "peripheral device identifier."

The parties agree that the term "peripheral device identifier" means "an element that identifies a peripheral device." (Doc. No. 231), at 2 ("JOINT CLAIM CONSTRUCTION"). However, the parties disagree as to its inclusion in the construction of the "capable of" phrases. Defendants' argument for the inclusion of the "peripheral device identifier" in the construction of the "capable of" phrases is that it flows logically from the parties' agreement that a "peripheral device identifier" identifies a peripheral device. DEFS.' BR. at 24. Plaintiffs argue that because the patentee did not use the term "peripheral device identifier" in the "capable of" phrases, it would be improper to insert that term (although agreed) in the construction of those phrases. REPLY at 10. Plaintiffs stress that the failure to include the term "peripheral device identifier" is because the "plurality of MAC addresses" in the claims may be, but are not limited to being the peripheral device identifier as required by the claims. *Id.* Plaintiffs contend that, when read in the context of the claims in which they are present, the "capable of" phrases are readily understood to mean "capable of being used by the hub device to distinguish the first peripheral device from other devices;" and "capable of being used to distinguish the peripheral device from other devices." PLS.' BR. at 25.

The Court agrees with Plaintiffs that had the patentee wanted to include the term "peripheral device identifier" in the capable of phrases contained in Claims 43 and 221, he could have done so, as both claims depend from claims which include "peripheral device identifier." When read in the context of Claims 43 and 221, Defendants' construction conflates the terms "peripheral device identifier" and "MAC address" and complicates the claims for the finder of fact.

Rather than use the term "peripheral device identifier," the claims use "a plurality of MAC addresses." The specification discloses that MAC addresses may be used to distinguish one peripheral device from another. '129 Patent at Figs. 9B, 9C, & 11–12; 1:55–2:14; 3:31–32 ("Each device is identified by a Media Access (MAC) address."), 3:60–4:3 ("The Hub 110 might also use MAC addresses to identify virtual PEAs within any one physical PEA 120. . . . The PEA 120 responds to the Hub 110 if it identifies its own MAC address or the Hub MAC address in the token and if the stream number in the token is active for the MAC address of the PEA 120."), 8:18–22 ("The MAC address 610 and stream number 620 in the token 640 together specify a particular PEA 120 to transmit or receive data, or, in the case of the Hub's MAC address 610, specify no, many, or all PEAs to receive data from the Hub 110 (depending on the stream number).") & 11:55–56 ("The Hub 110 sends the new MAC address 610 in an attach-assignment message to the now-identified PEA 120 . . . ."). These disclosures demonstrate that "capable of being used for identification in association" with peripheral devices refers to distinguishing different peripheral devices, or multiple virtual devices within a single physical device, that are attached to (or requesting attachment to) a network.

While the Court acknowledges the specification's disclosure that a MAC address may identify a device as a whole, or multiple virtual entities within a single device, the Court finds the addition of "and subcomponents thereof" to the construction unnecessary. This addition would only raise ambiguity as to the meaning of "subcomponent," a term not found in the '129 Patent, and confuse the plain language of the claims. The Court therefore construes "capable of being used for identification in association with the first peripheral device" and "capable of being used for identification in association therewith" as "capable of being used to distinguish the first peripheral device from other devices" and "capable of being used to distinguish the peripheral

device from other devices," respectively.

Claim Language	Plaintiff's Proposal	Defendants' Proposal	Court's Construction
3. "availability of the hub device for peripheral device attachment" "availability of the first peripheral device for communication with the hub device" "availability of the peripheral device for communication with the hub device"			
129: 14, 27	"the hub device is available for unattached peripheral devices to establish an attachment relationship" "the [first] peripheral device is available to establish an attachment relationship with the hub device"	"availability of an identified hub device for attachment to any peripheral device" "availability of the [first] peripheral device for communication with the hub device in step (i)"	"availability of the hub device for attachment to any peripheral device" No construction necessary (agreed)

In the "availability" briefing provided to the Court, the parties extensively disputed whether the message from the hub device indicated availability to all peripheral devices or only to unattached peripheral devices. PLS.' BR. at 16–17; DEFS.' BR. at 14. At the *Markman* hearing, the parties clarified that their real dispute is actually whether the message from the hub device, signaling its availability, is a general message sent to all devices, or whether the hub device targets the message to a specific peripheral device or group of devices.

At the *Markman* hearing, the parties agreed with the Court's proposal that the term "availability of the [first] peripheral device for communication with the hub device" requires no construction. As to the term "availability of the hub device for peripheral device attachment," the Court proposed the following construction: "availability of the hub device for attachment to any

peripheral device."

Plaintiffs argue that the word "any" should not be included in the Court's construction because it precludes the possibility that a message could be targeted to a specific device. Plaintiffs support their contention that a message could be targeted to a specific device by pointing to dependent claims that indicate the message might be broadcast. For example, Claims 32 and 33 indicate the "…transceiver is configured to receive a signal broadcast from the hub device…" and the "…transceiver is configured to receive a broadcast signal from the hub device…" '129 Patent at 16:4–8. Plaintiffs contend that because these dependent claims say the message might be a broadcast message, the message is differentiated and not limited to just a broadcast message. Similarly, Plaintiffs argue that because Claims 14 and 27 refer to the "hub device" and the "peripheral device" in the singular form and not in the plural, it supports their contention that a message may be targeted to one specific device. Accordingly, Plaintiffs suggested that the Court construe the phrase as "availability of the hub device for attachment to a peripheral device."

Defendants counter that there is no dispute that the specification's disclosed embodiments include only a message that is generally sent, and argue that there is nothing in the specification that would limit the message to something more specific. '129 Patent at 11:22–43 (The Hub 110 periodically broadcasts heartbeats…"). Defendants also argue that the structure of Claim 14 suggests that the first message is sent out generally in step (i) for peripheral device attachment. ("send message to indicate the availability of the hub device for peripheral device attachment") 14:44–46. This step, Defendants argue, is contrasted with the following steps, where, in the second step, a specific message is received from a specific device, and in the third step, communication is directed to a specific device. ("receive, from a first peripheral device, a

message indicating the availability of the first peripheral device for communication with the hub device;" and "send, to the first peripheral device, a signal including a first peripheral device identifier.") 14:47–51. Defendants counter Plaintiffs' differentiation argument by asserting it is not clear that by using the term broadcast, the patentee meant to differentiate from the general message disclosed in the specification and articulated in step (i) of Claim 14. Plaintiffs replied that Defendants are improperly reading the specification into the claim.

Step (i) of Claims 14 and 27 recite a general message indicating the availability of the hub device for peripheral device attachment. Claims 14 and 27 recite:

> 14. A hub device for use within a personal area network, comprising:
> circuitry, and
> a transceiver in communication with the circuitry, the hub device configured to cause the transceiver to
> i) send a message to indicate the availability of the hub device for peripheral device attachment,
> ii) receive, from a first peripheral device, a message indicating the availability of the first peripheral device for communication with the hub device,
> iii) send, to the first peripheral device, a signal including a first peripheral device identifier,
> iv) receive, from the first peripheral device, a response,
> v) send a hub response to the first peripheral device, and
> vi) receive, from the first peripheral device, a second peripheral response including the first peripheral device identifier. ('129 Patent at 14:39–56)
>
> ▪▪
>
> 27. A peripheral device for use within a personal area network, comprising:
> circuitry, and
> a transceiver in communication with the circuitry, the peripheral device configured to cause the transceiver to
> i) receive a sent message from a hub device to indicate the availability of the hub device for peripheral device attachment,
> ii) send, to the hub device, a message indicating the availability of the peripheral device for communication with the hub device,
> iii) receive, from the hub device, a signal including a peripheral device identifier,
> iv) send a response to the hub device,
> v) receive, from the hub device, a hub response, and

vi) send, to the hub device, a second peripheral response including the peripheral device identifier. ('129 Patent at 15:39–56)

As between steps (i) and (ii) found in Claims 14 and 27, there is a transition from the message sent "for peripheral device attachment" in step (i), to "availability of the [first] peripheral device" in step (ii). Had the patentee wanted to indicate a specific targeted message in step (i) he could have done so, as was done with communication in step (ii) using the definite article "the" to indicate a specific device. This is further supported by the specification, which discloses a general message whereby the hub device sends "heartbeat" messages that can be received by any PEA within range. '129 Patent at 7:67–8:3 (referencing "the Hub's use of its MAC address to broadcast its heartbeat 770…to all PEAs."). As such, Plaintiffs' differentiation argument is insufficient to conclude that the hub device targets a message to a specific peripheral device. "[C]laim differentiation is a rule of thumb that does not trump the clear import of the specification." *Edwards Lifesciences LLC v. Cook Inc.*, 582 F.3d 1322, 1331 (Fed. Cir. 2009).

Therefore, the Court construes "availability of the hub device for peripheral device attachment" as "availability of the hub device for attachment to any peripheral device." As to the remaining "availability" phrases, the parties agreed at the *Markman* hearing that no constructions were necessary.

Claim Language	**Plaintiff's Proposal**	**Defendants' Proposal**	**Court's Construction**
4. "virtual entities"			
129: 45, 46, 224	"a simulation or emulation of physical entities, or subsystems of a system"	"emulation of physical entities"	"simulation of physical entities" (agreed)

At the *Markman* hearing, the parties agreed to the following construction for "virtual entities" proposed by the Court: "simulation of physical entities."

Claim Language	Plaintiff's Proposal	Defendants' Proposal	Court's Construction
5. "additional identifiers"			
129: 81, 95, 259	"one or more elements that identifies, other than the first peripheral device identifier"	"one or more elements that identifies, other than the first peripheral device identifier or a MAC address"	"one or more elements that identifies, other than the first peripheral device identifier"

With regard to the term "additional identifiers," the parties seemingly agree on the basic contours of a construction. However, a dispute remains as to whether a MAC address can be an "additional identifier." Defendants maintain that an "additional identifier" cannot be a MAC address. DEFS.' BR. at 25. Specifically, Defendants argue that because "[t]he parties agree that both 'MAC address(es)' and 'peripheral device identifier[s]' are 'identifiers" that serve the function of 'identif[ying]' devices, "[t]he inventor's use of a different term, 'additional identifiers,' in Claims 81, 95, and 259 gives rise to a presumption that this phrase must refer to something other than the 'identifier' of a 'MAC address' referred to in the earlier claims." *Id.* (citing PLS.' BR. at 10 & 26–27). Plaintiffs argue that Defendants' construction reads out the plain and ordinary meaning of the word "additional" because there is nothing about the word additional that would preclude "additional identifiers" from meaning simply more of the same type of identifier. REPLY at 10.

The resolution to the parties' dispute calls for the reconciliation of Claims 43 and 95. Claims 43 and 95 recite:

> 43. The hub device according to claim 14, wherein the hub device is configured such that a plurality of MAC addresses is capable of being used for identification in association with the first peripheral device. ('129 Patent at 16:41–44).
>
> ▪▪
>
> 95. The hub device according to claim 43, wherein the hub device is configured to cause the transceiver to communicate between the hub device and the first peripheral device, utilizing one or more additional identifiers. ('129 Patent at 19:59–62).

"Additional identifier" is found in Claim 95, which depends from Claim 43, which depends from Claim 14. There is no dispute that all three claims discuss identifiers. Claim 14 contains the "first peripheral device identifier," Claim 43 contains a "plurality of MAC addresses," and Claim 95 contains "one or more additional identifiers." '129 Patent at 14:51, 55–56; 16:42, 19:62. The dispute is whether "additional identifiers," as used in Claim 95, must be something other than the plurality of MAC addresses in Claim 43. Defendants argue that, logically, "additional identifiers" as used in Claim 95 (which depends from 43 and 14) must be a third category of identifiers, something other than the "first peripheral identifier" used in Claim 14 and something other than the "plurality of MAC addresses" used in Claim 43. Again, Plaintiffs maintain that "additional identifiers" just means more identifiers, which could include more of the same type of identifiers.

There is nothing in the specification that directly resolves the dispute between the parties. However, the word "additional" as used in the claims and the specification is used in a manner consistent with its plain and ordinary meaning. ("[d]uring attachment…, the PEA 120 may have two additional active MAC addresses 610, the one it selected for attachment and the one the Hub 110 assigned to the PEA 120.") '129 Patent at 9:13–16. Essentially, the dispute between the

parties revolves around the plain and ordinary meaning of the word "additional." Defendants would read it to mean "other" while Plaintiffs would read it to mean "more." However, both of these synonyms showcase that either interpretation is consistent with the plain and ordinary meaning of the word as used in the '129 Patent. These easily understood meanings are not mutually exclusive, although the parties' dispute presents them to be. The '129 Patent gives no indication that the meaning should be limited to one interpretation or the other. Thus, "additional identifiers" could mean more of the same identifiers and/or other identifiers. Therefore, the Court finds it improper to further limit the meaning of "additional identifiers" to exclude "MAC addresses," which are indisputably used in Claim 43 as identifiers.

Accordingly, in conjunction with the agreed upon portion of the parties' construction, the Court construes "additional identifiers" to mean "one or more elements that identifies, other than the first peripheral device identifier."

Claim Language	Plaintiff's Proposal	Defendants' Proposal	Court's Construction
6. "reattachment"			
129: 262, 263	"reestablish an attachment relationship"	"initiating attachment after detachment caused by exceeding a predefined threshold"	No construction necessary (agreed)

At the *Markman* hearing, the parties agreed that no construction was necessary for the term "reattachment."

Claim Language	Plaintiff's Proposal	Defendants' Proposal	Court's Construction
7. "controlling retransmission"			
129: 55, 233	"exerting control over a repeated	Plain and ordinary meaning	"controlling a repeated

	transmission to the same addressee of a previously transmitted signal"		transmission of previously transmitted data" (agreed)

At the *Markman* hearing, the parties agreed to the following construction proposed by the Court for the term "controlling retransmission:" "controlling a repeated transmission of previously transmitted data."

Claim Language	Plaintiff's Proposal	Defendants' Proposal	Court's Construction
8. "separate class of MAC address"			
129: 63	No construction necessary Alternatively, "separate class of an address that uniquely identifies a device or group of devices on a shared communication medium"	"MAC address with a different configuration"	"different category of MAC addresses" (agreed)

At the *Markman* hearing, the parties agreed to the following construction proposed by the Court for the term "separate class of MAC address:" "different category of MAC addresses."

CONCLUSION

For the foregoing reasons, the Court adopts the constructions set forth above.

So ORDERED and SIGNED this 15th day of January, 2013.

JOHN D. LOVE
UNITED STATES MAGISTRATE JUDGE

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
TYLER DIVISION

AZURE NETWORKS, LLC et al.,	§	
	§	**NO. 6:11cv139 MHS-JDL**
vs.	§	
	§	**PATENT CASE**
CSR PLC, et al.	§	

ORDER OVERRULING OBJECTIONS AND
DENYING MOTIONS FOR RECONSIDERATION

The above entitled and numbered civil action was referred to United States Magistrate Judge John D. Love pursuant to 28 U.S.C. § 636. The Memorandum Opinion and Order of the Magistrate Judge (Doc. No. 266) ("Opinion"), which contains his construction of disputed terms in U.S. Patent Nos. 7,756,129 ("the '129 Patent"), has been presented for consideration. Plaintiff Azure Networks, LLC ("Azure") has filed objections and a motion for reconsideration to the Opinion (Doc. No. 273) ("AZURE OBJ.") and Defendants CSR plc, Cambridge Silicon Radio International, LLC, Atheros Communications, Inc., Broadcom Corporation, Marvell Semiconductor, Inc., Qualcomm Incorporated, Ralink Technology Corporation [Taiwan], Ralink Technology Corporation [USA], and Texas Instruments, Inc. (collectively "Defendants") have also filed objections and a motion for reconsideration to the Opinion pursuant to Federal Rule of Civil Procedure 72(a) (Doc. No. 272) ("DEFS.' OBJ."). For the reasons set forth below, the Court adopts the Magistrate Judge's opinion with the following clarifications.

a. "MAC Address"

Azure objects to the Magistrate Judge's construction of the term "MAC address," arguing that the patentee did not act as his own lexicographer and requesting that the Court clarify that the term "generated," as it is used in the Magistrate Judge's construction, encompasses

"selected," "assigned," and "created". AZURE OBJ. at 2–3. As to the lexicography issue, the Court agrees with the Magistrate Judge's finding that the patentee did act as his own lexicographer, expressly defining "MAC address" as "Media Access address" as opposed to the customary "Medium Access Control address." '129 Patent at 3:32. Along these lines, the Court also agrees with the Magistrate Judge's finding that what is defined and consistently disclosed is a MAC address that originates with the hub device, such that it is not universally assigned at the time of manufacture. OPINION at 8–9. To that extent, the Court clarifies the construction; what is articulated by the use of the word "generated" in the construction, is the finding that the MAC address must be created or assigned by the hub device. That is not to limit the term to a preferred embodiment or foreclose a particular disclosure, but to construe it broadly in light of the consistent disclosure that the MAC address, as defined by the patentee, is not universally assigned at the time of manufacture, but rather originates with the hub device. Therefore, the Court adopts the Magistrate Judge's construction of "MAC address" as "a device identifier generated by the hub device."

b. "availability of the hub device for peripheral device attachment"

Azure also objects to the Magistrate Judge's construction of "availability of the hub device for peripheral device attachment" as limiting the phrase to a disclosed embodiment. AZURE OBJ. at 13–15. The Court finds that the Magistrate Judge's construction of this claim limitation does not limit the claim in the manner Azure suggests. By construing the phrase "availability of the hub device for peripheral device attachment" as "availability of the hub device for attachment to any peripheral device," the construction reflects the broad drafting of the claim as recited, "send a message to indicate the availability of the hub device for peripheral device attachment." '129 patent at 44–45. The Magistrate Judge's construction merely reflects

the claim language and consistent disclosure that the message is not required to be sent to a certain device, but rather, is broadly recited for "peripheral device attachment." OPINION at 17–18. Therefore, the Court adopts the Magistrate Judge's construction of "availability of the hub device for peripheral device attachment" as "availability of the hub device for attachment to any peripheral device."

c. Capable phrases

Defendants object to the Magistrate Judge's construction of the "capable of" phrases. DEFS.' OBJ. at 4–6. Having reviewed the parties' submissions, the Court is of the opinion that the constructions of the Magistrate Judge are correct.

d. Additional Identifiers

Defendants object to the Magistrate Judge's construction of the "additional identifiers." DEFS.' OBJ. at 7–8. Having reviewed the parties' submissions, the Court is of the opinion that the constructions of the Magistrate Judge are correct.

Accordingly, the Court **ADOPTS** the Opinion of the United States Magistrate Judge as the opinion of this Court, with the above clarifying comments. All objections are overruled and all motions for reconsideration are **DENIED**.

It is SO ORDERED.

SIGNED this 17th day of May, 2013.

MICHAEL H. SCHNEIDER
UNITED STATES DISTRICT JUDGE

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
TYLER DIVISION

AZURE NETWORKS, LLC and TRI-COUNTY EXCELSIOR FOUNDATION	§	
Plaintiffs,	§	**CIVIL ACTION No. 6:11cv139 MHS-JDL**
v.	§	
CSR PLC LLC, et al.,	§	
Defendants.		

REPORT AND RECOMMENDATION OF UNITED STATES MAGISTRATE JUDGE

Before the Court is Defendants'[1] Motion to Dismiss Plaintiff Tri-County Excelsior Foundation ("TCEF") for Lack of Standing ("MOTION") (Doc. No. 179). TCEF and Plaintiff Azure Networks, LLC ("Azure") (collectively "Plaintiffs") have filed a Response ("RESP.") (Doc. No. 185). Defendants have filed a Reply (Doc. No. 188) ("REPLY") and Plaintiffs have filed a Sur-Reply (Doc. No. 196) ("S. REPLY"). Having fully considered the parties' arguments and for the reasons set forth herein, the Court **RECOMMENDS** that Defendants' Motion to Dismiss for Lack of Standing be **GRANTED**.

BACKGROUND

On March 22, 2011, Plaintiffs filed the instant lawsuit, alleging Defendants infringe several claims of U.S. Patent No. 7,756,129 ('129 Patent). (Doc. No. 1) ("COMPLAINT"). The '129 Patent is entitled "Personal Area Network with Automatic Attachment and Detachment"

[1] Moving Defendants are: CSR plc and Cambridge Silicon Radio International LLC; Qualcomm Atheros, Inc.; Broadcast Corporation; Marvell Semiconductor, Inc.; Qualcomm Incorporated; Ralink Technology Corporation [Tawain]; and Ralink Technology Corporation [USA] (collectively "Defendants").

and discloses a Personal Area Network ("PAN"), which is managed by a hub device and can support wireless "attachment" of multiple Personal Electronic Accessories ("PEAs"). '129 Patent at 3:10–32.

Robert Donaghey, the sole inventor of the '129 Patent, assigned his rights to BBN Technologies Corp. ("BBN") in 2007, who then assigned the '129 Patent to Azure. Azure is a Texas limited liability company with its principal place of business in Longview, Texas. COMPLAINT at 2. In June 2010, Azure donated numerous patents and patent applications (including the application that later issued as the patent-in-suit) to TCEF. TCEF is a Texas non-profit corporation with its principal place of business in Marshall, Texas. *Id.* On July 30, 2010, TCEF and Azure entered into an exclusive license agreement whereby Azure received a "worldwide, transferable, exclusive license under the ['129 Patent], with the right to sublicense others, to (i) make, have made, use, sell, offer to sell, import and lease any products, (ii) use and perform any method, process, and/or services, and (iii) otherwise practice any invention in any manner, such that Azure has full right to enforce and/or sublicense the ['129 Patent]." AGREEMENT at §2.1.

On May 4, 2012, Defendants filed the instant Motion, arguing that TCEF lacks constitutional standing to bring the instant suit because TCEF transferred all substantial rights in the '129 Patent to Azure via the July 2010 agreement. MOTION at 1. Defendants further argue that any remaining rights of TCEF do not give it standing to sue for infringement. *Id.*

LEGAL STANDARD

Standing is required to bring suit in federal court and must be present at the time the suit is filed. *Sicom Sys, Ltd. v. Agilent Techs., Inc.*, 427 F.3d 971, 975–76 (Fed. Cir. 2005) (citation omitted). To establish constitutional standing, "[a] plaintiff must allege personal injury

fairly traceable to the defendant's allegedly unlawful conduct and likely to be redressed by the requested relief." *Hein v. Freedom from Religion Found.*, 551 U.S. 587, 598 (2007) (quoting *Allen v. Wright*, 468 U.S. 737, 751 (1984)). Thus, the burden of establishing standing is on the plaintiff. *Sicom*, 427 F.3d at 976 (citation omitted).

In a patent infringement case such as this, a plaintiff's standing is derived from the Patent Act. *Intellectual Prop. Dev., Inc. v. TCI Cablevision of Cal., Inc.*, 248 F.3d 1333, 1345 (Fed. Cir. 2001) (citing 35 U.S.C. § 281). The Patent Act provides standing in patentees to whom patents issue, as well as the successors in title to the patent. 35 U.S.C. §§ 100(d), 281. Thus, a party having legal title to a patent has standing to sue for infringement. *Morrow v Microsoft Corp.*, 499 F.3d 1332, 1339 (Fed. Cir. 2007).

A party has standing to sue on its own if it holds all exclusionary rights and suffers constitutional injury in fact from infringement. *Morrow*, 499 F.3d at 1339–40. If a party does not hold all the exclusionary rights, but instead holds "all substantial rights," the party still has standing to sue on its own. *Morrow*, 499 F.3d at 1340 ("[w]hen a party holds all rights *or all substantial rights*, it alone has standing to sue for infringement") (emphasis added). The Federal Circuit has noted that the substantial rights inquiry "is a proxy for the statutory requirement that a party bringing an infringement suit have the interests of a patentee," thus becoming the "effective patentee." *Morrow*, 499 F.3d at 1340 n.6; *Ortho Pharm. Corp. v. Genetics Inst.*, 52 F.3d 1026, 1032 (Fed. Cir. 1995) ("Where a patentee makes an assignment of all significant rights under the patent, such assignee may be deemed the effective 'patentee' under the statute and has standing to bring a suit in its own name for infringement.").

A party who holds some exclusionary rights—but not all substantial rights to a patent—and is injured by infringement can only bring suit in conjunction with the owner of the patent to

satisfy prudential standing concerns. *Morrow*, 499 F.3d at 1340 (citing *Indep. Wireless Tel. Co. v. Radio Corp. of Am.*, 269 U.S. 459, 467, 469 (1926)); *Ortho Pharm.*, 52 F.3d at 1031 ("To have coplaintiff standing in an infringement suit, a licensee must hold some of the proprietary sticks from the bundle of patent rights, albeit a lesser share of rights in the patent than for an assignment and standing to sue alone."). Joining the patent holder avoids the "potential for multiple litigations and multiple liabilities and recoveries against the same infringer." *Morrow*, 499 F.3d at 1340; *see also Ortho Pharm.*, 52 F.3d at 1032 Finally, parties who hold less than all substantial rights and lack exclusionary rights under the patent, lack constitutional standing to sue for infringement. *Morrow*, 499 F.3d at 1340–41.

DISCUSSION

Defendants argue that because TCEF fully transferred its rights in the '129 Patent to Azure, the transfer of rights constituted an assignment thereby relinquishing TCEF's ability to sue for infringement. MOTION at 3. Specifically, Defendants contend that because TCEF assigned "all right, title, interest [in] all claims, causes of action and enforcement rights, whether currently pending, filed or otherwise under the ['129 Patent]," TCEF lacks standing. *Id.* at 4. Further, Defendants contend that TCEF's only remaining interest to practice the '129 Patent internally does not confer standing, even with Azure joined as a co-plaintiff. *Id.* at 5. In response, TCEF contends it has standing as it did not transfer all substantial rights to Azure; specifically, TCEF will regain all of the rights under the '129 Patent absent a renewal of the license agreement. RESP. at 3. In their Reply, Defendants maintain that the fact that TCEF holds a reversionary right is not dispositive of the standing issue, as the license does not have a fixed termination date unrelated to the expiration of the patent (citing *Prima Tek II, LLC v. A-Roo Co.*, 222 F.3d 1372, 1374 (Fed. Cir. 2000), where the Federal Circuit held a party was not required to

be joined under similar circumstances). REPLY at 2–3. Plaintiffs respond that Defendants' citation of *Prima Tek II* is misplaced, as it dealt with whether a party must be joined, not whether a party should be dismissed as improper. S. REPLY at 1.

A. Ownership of the '129 Patent

The threshold determination for the Court is whether Azure is the owner of the '129 Patent. A patent may not have multiple separate owners for purposes of determining standing to sue. *Alfred E. Mann Foundation for Scientific Research v. Cochlear Corp*., 604 F.3d 1354, 1360 (Fed. Cir. 2010). In determining ownership of the patent, "the question is whether the license agreement transferred sufficient rights to the exclusive licensee to make the licensee the owner of the patents in question. If so, the licensee may sue but the licensor may not. If not, the licensor may sue, but the licensee alone may not" *Mann Found*., 604 F.3d at 1360. If Azure is the owner of the '129 Patent, then it alone has standing to sue. However, "[w]hen there is an exclusive license agreement…but the exclusive license does not transfer enough rights to make the licensee the patent owner, either the licensee or the licensor may sue, but both of them generally must be joined as parties to the litigation. *Aspex Eyewear,* 434 F.3d at 1344 (citing *Independent Wireless Tel. Co. v. Radio Corp.,* 269 U.S. 459, 466, 46 S.Ct. 166, 70 L.Ed. 357 (1926)).

The Federal Circuit has noted several factors to consider in determining whether a licensor has transferred away sufficient rights to render an exclusive licensee the owner of a patent. *Mann Found.*, 604 F.3d at 1360–61. Some of these factors include:

> transfer of the exclusive right to make, use, and sell products or services under the patent[,]…the scope of the licensee's right to sublicense, the nature of license provisions regarding the reversion of rights to the licensor following breaches of the license agreement, the right of the licensor to receive a portion of the recovery in infringement suits brought by the licensee, the duration of the license rights granted to the licensee, the ability of the licensor to supervise and control the licensee's activities, the obligation of the licensor to continue paying patent

> maintenance fees, and the nature of any limits on the licensee's right to assign its interests in the patent.

Id.

The Federal Circuit emphasized that frequently "the nature and scope of the exclusive licensee's purported right to bring suit, together with the nature and scope of any right to sue purportedly retained by the licensor, is the most important consideration." *Id.* at 1361. Here, Azure has the "exclusive right to enforce or defend" the '129 Patent, as well as all interest to "all claims, causes of action and enforcement rights, whether currently pending, filed or otherwise." AGREEMENT § 4.4. By virtue of the parties' agreement, Azure exclusively holds the right to bring suit. Pursuant to the parties' agreement, TCEF only retains the right to internally practice the methods/processes of the patent, but cannot transfer or sublicense any rights of the patent. The only mention of a litigation interest for TCEF is where the agreement states "at Azure's request and expense, TCEF agrees to join Azure as a party and cooperate with Azure in any patent infringement suit, if, desirable to address a legal issue (e.g. establish sufficient standing to enforce the Patent(s)i Application(s) against third parties, etc.)" *Id.* Here, TCEF has not retained any right to sue by virtue of the agreement; at best it maintains an obligation to join litigation at Azure's request.[2] Therefore, the Court finds that this factor strongly supports a finding that Azure is owner of the '129 Patent.

Turning to the remaining factors, as noted above, TCEF does not retain the right to sublicense any rights of the '129 Patent. While the license agreement does provide TCEF a reversionary right, that right may never vest before the expiration of the '129 Patent. The license agreement is set to expire on March 27, 2018, or "at the end of each year thereafter, unless TCEF

[2] Although the signed agreement conceptualizes TCEF's joinder in an infringement action at Azure's request, that fact alone cannot confer standing on TCEF. While "[e]xpress covenants may, of course, regulate the duties between the licensor and licensee to implement the rights of the parties," a "contract cannot change the statutory requirement for suit to be brought by the 'patentee.'" *Ortho*, 52 F.3d at 1034.

notifies Azure at least 30 days in advance of its intent to renew for an additional year." AGREEMENT § 7.8. Notably, this renewal provision has no hard termination date—a date beyond which the license cannot be renewed—and could therefore be renewed until the expiration of the '129 Patent, meaning TCEF may never have ownership of the patent again during its period of exclusivity. *See Aspex*, 434 F.3d at 1343 (distinguishing cases wherein a transferred patent may return to the assignor and contained no hard termination date in determining there was no assignment of rights). The only interest TCEF maintains in the present litigation is a 33% interest in profits. AGREEMENT §3.1. TCEF, however, maintains no substantial right to supervise and control Azure's activities with respect to its enforcement of the '129 Patent, and has no obligation to continue paying patent maintenance fees. As such, the overwhelming weight of the factors, including the most important factor noted by the Federal Circuit, suggests that Azure is the owner of the '129 Patent. Therefore, in light of the evidence before it, the Court finds that Azure is the owner of the '129 Patent. Accordingly, because Azure was the owner of the '129 Patent at the time the complaint was filed, TCEF is not a necessary party under Rule 19. FED.R.CIV.P. 19(a)(1); *Independent Wireless Tel. Co.*, 269 U.S. at 466.

B. Whether TCEF has Standing to Sue

While the Court finds that Azure is the owner of the '129 Patent, a prudential analysis is still required to determine whether TCEF maintains enough rights with respect to the '129 Patent to confer standing. As mentioned previously, "[t]o have co-plaintiff standing in an infringement suit, a licensee must hold some of the proprietary sticks from the bundle of patent rights, albeit a lesser share of rights in the patent than for an assignment and standing to sue alone." *Ortho Pharm.*, 52 F.3d at 1031. There is no dispute the TCEF presently holds no exclusionary rights. TCEF only retains a personal, non-exclusive, and non-transferrable license to internally practice

the methods/process of the patent. AGREEMENT §2.3. Notably, TCEF cannot transfer or sublicense any rights of the patent. *Id.* TCEF has not reserved rights to assign any interest in the '129 Patent, not even with Azure's consent. Where the ultimate injury at issue is infringement, any injury to TCEF through the accused infringement of the '129 Patent is tenuous at best based on the sparse rights it retains with respect to the '129 Patent. Without any semblance of an exclusionary right in the '129 Patent, the Court is hard pressed to find a legal injury that would confer constitutional standing on TCEF in the present case.

For the reasons stated herein, the Court finds that TCEF does not have standing to sue for infringement of the '129 Patent. The Court therefore **RECOMMENDS** that Defendants' Motion to Dismiss for Lack of Standing be **GRANTED.**

CONCLUSION

For all the foregoing reasons, the Court **RECOMMENDS** that Defendants' Motion to Dismiss for Lack of Standing be **GRANTED**. Within fourteen (14) days after receipt of the Magistrate Judge's Report, any party may serve and file written objections to the findings and recommendations contained in the Report. A party's failure to file written objections to the findings, conclusions and recommendations contained in this Report within fourteen (14) days after being served with a copy shall bar that party from *de novo* review by the district judge of those findings, conclusions and recommendations and, except on grounds of plain error, from appellate review of unobjected-to factual findings and legal conclusions accepted and adopted by the district court. *Douglass v. United States Auto. Ass'n*, 79 F.3d 1415, 1430 (5th Cir. 1996).

So ORDERED and SIGNED this 16th day of January, 2013.

JOHN D. LOVE
UNITED STATES MAGISTRATE JUDGE

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
TYLER DIVISION

AZURE NETWORKS, LLC et al.,	§	
	§	**NO. 6:11cv139 MHS-JDL**
vs.	§	
	§	**PATENT CASE**
CSR PLC, et al.	§	

ORDER ADOPTING REPORT AND RECOMMENDATION OF UNITED STATES MAGISTRATE JUDGE

The above entitled and numbered civil action was referred to United States Magistrate Judge John D. Love pursuant to 28 U.S.C. § 636. The Report and Recommendation of the Magistrate Judge (Doc. No. 269) ("R&R"), has been presented for consideration. Plaintiffs Azure Networks, LLC and Tri-County Excelsior Foundation (collectively "Plaintiffs") have filed objections to the Court's Report and Recommendation (Doc. No. 270). Defendants CSR plc, Cambridge Silicon Radio International LLC, Qualcomm Atheros, Inc., Broadcom Corporation, Marvell Semiconductor, Inc., Qualcomm Incorporated, Ralink Technology Corporation [Taiwan], and Ralink Technology Corporation [USA] have filed a Response (Doc. No. 281), and Plaintiffs have filed a Reply (Doc. No. 283).

In their Reply, Plaintiffs cite, for the first time, the Internal Revenue Code to demonstrate the relationship and intent of the parties, as well as a Treasury Regulation to support a finding that TCEF did not transfer all substantial rights. REPLY at 1–2. However, in the motion briefing, the Magistrate Judge was not asked to determine the tax relationships, benefits, or consequences deriving from the conveyance of the patent-in-suit from Azure to TCEF and the exclusive license conveyed to Azure. Rather, the Magistrate Judge was asked to determine who has standing to sue. To that end, as the Magistrate Judge found, what was ultimately included in the exclusive license agreement was the conveyance of all substantial rights. Considered in that context,

having reviewed the parties' submissions, the Court is of the opinion that the Magistrate Judge's findings that: (1) Azure is the owner of U.S. Patent No. 7,756,129 ("the '129 Patent"); (2) TCEF is not a necessary party; and (3) TCEF does not have standing to sue for infringement of the '129 Patent, are correct. Again, determining the tax implications presented by the conveyance referred to in Plaintiffs' Reply was not before the Magistrate Judge. Any tax issues, to the extent necessary, should be addressed in another forum.

Therefore, the Court hereby **ADOPTS** the Report and Recommendation of the United States Magistrate Judge as the opinion of this Court. All objections are **OVERRULED.**

Accordingly, the defendants' motion to dismiss Plaintiff Tri-County Excelsior Foundation (Doc. No. 179) is GRANTED.

It is SO ORDERED.

SIGNED this 6th day of March, 2013.

MICHAEL H. SCHNEIDER
UNITED STATES DISTRICT JUDGE

IN THE UNITED STATES DISTRICT COURT

FOR THE EASTERN DISTRICT OF TEXAS

TYLER DIVISION

AZURE NETWORKS, LLC, et al.	§	
	§	
Plaintiffs,	§	**Civil Action No. 6:11-CV-139**
	§	
v.	§	
	§	**JURY TRIAL DEMANDED**
CSR PLC, et al.,	§	
	§	
***Defendants*.**	§	

ORDER

The Joint Motion filed by Plaintiffs Azure Networks, LLC and Tri-County Excelsior Foundation ("Plaintiffs") and Defendant Texas Instruments Inc. ("TI") to Dismiss Claims and Counterclaims Without Prejudice under Fed. R. Civ. P. 41(a)(2) and (c) (Doc. No. 292) shall be, and hereby is, GRANTED. All claims and counterclaims asserted by and between Plaintiff and TI in this action are hereby DISMISSED WITHOUT PREJUDICE.

Plaintiffs and TI will each bear their own costs, expenses and legal fees.

It is SO ORDERED.

SIGNED this 30th day of May, 2013.

MICHAEL H. SCHNEIDER
UNITED STATES DISTRICT JUDGE

US007756129B2

(12) **United States Patent**
Donaghey

(10) **Patent No.: US 7,756,129 B2**
(45) **Date of Patent: *Jul. 13, 2010**

(54) **PERSONAL AREA NETWORK WITH AUTOMATIC ATTACHMENT AND DETACHMENT**

(75) Inventor: **Robert J. Donaghey**, Lexington, MA (US)

(73) Assignee: **Azure Networks, LLC**, Longview, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 282 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/728,246**

(22) Filed: **Mar. 23, 2007**

(65) **Prior Publication Data**

US 2007/0274309 A1 Nov. 29, 2007

Related U.S. Application Data

(63) Continuation of application No. 10/894,406, filed on Jul. 19, 2004, now Pat. No. 7,218,633, which is a continuation of application No. 09/535,591, filed on Mar. 27, 2000, now Pat. No. 6,804,232.

(51) **Int. Cl.**

H04L 12/28	(2006.01)
H04J 3/14	(2006.01)
G08C 15/00	(2006.01)
G06F 11/00	(2006.01)
G01R 31/08	(2006.01)

(52) **U.S. Cl.** **370/389**; 370/252; 370/400; 370/401; 709/224

(58) **Field of Classification Search** 370/230–252, 370/310–389, 400–452; 709/202–217, 220–229
See application file for complete search history.

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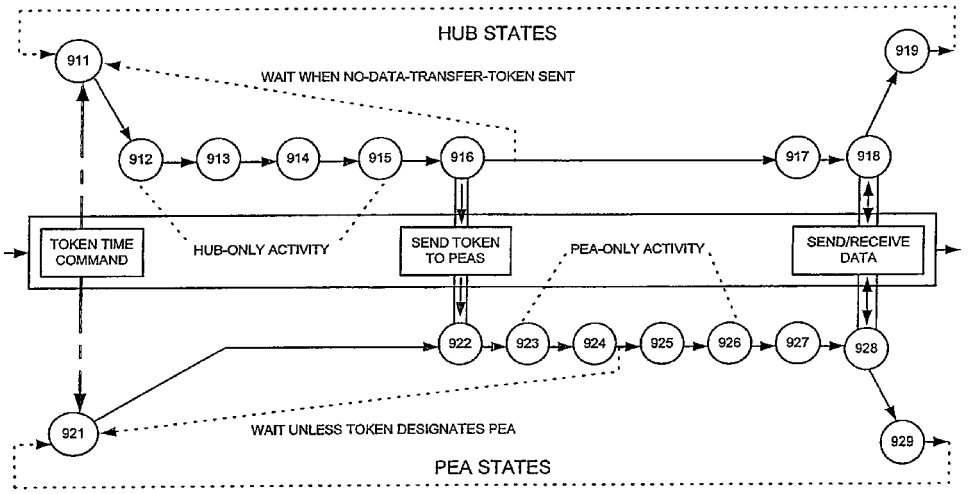
(Continued)

Primary Examiner—Man Phan
(74) *Attorney, Agent, or Firm*—The Caldwell Firm, LLC; Patrick E. Caldwell, Esq.

(57) **ABSTRACT**

A network (**100**) includes a hub device (**110**) and at least one unattached peripheral device (**120**). The unattached peripheral device (**120**) transmits an attach request to the hub device (**110**) with a selected address, receives a new address from the hub device to identify the unattached peripheral device (**120**), and communicates with the hub device (**110**) using the new address.

401 Claims, 17 Drawing Sheets



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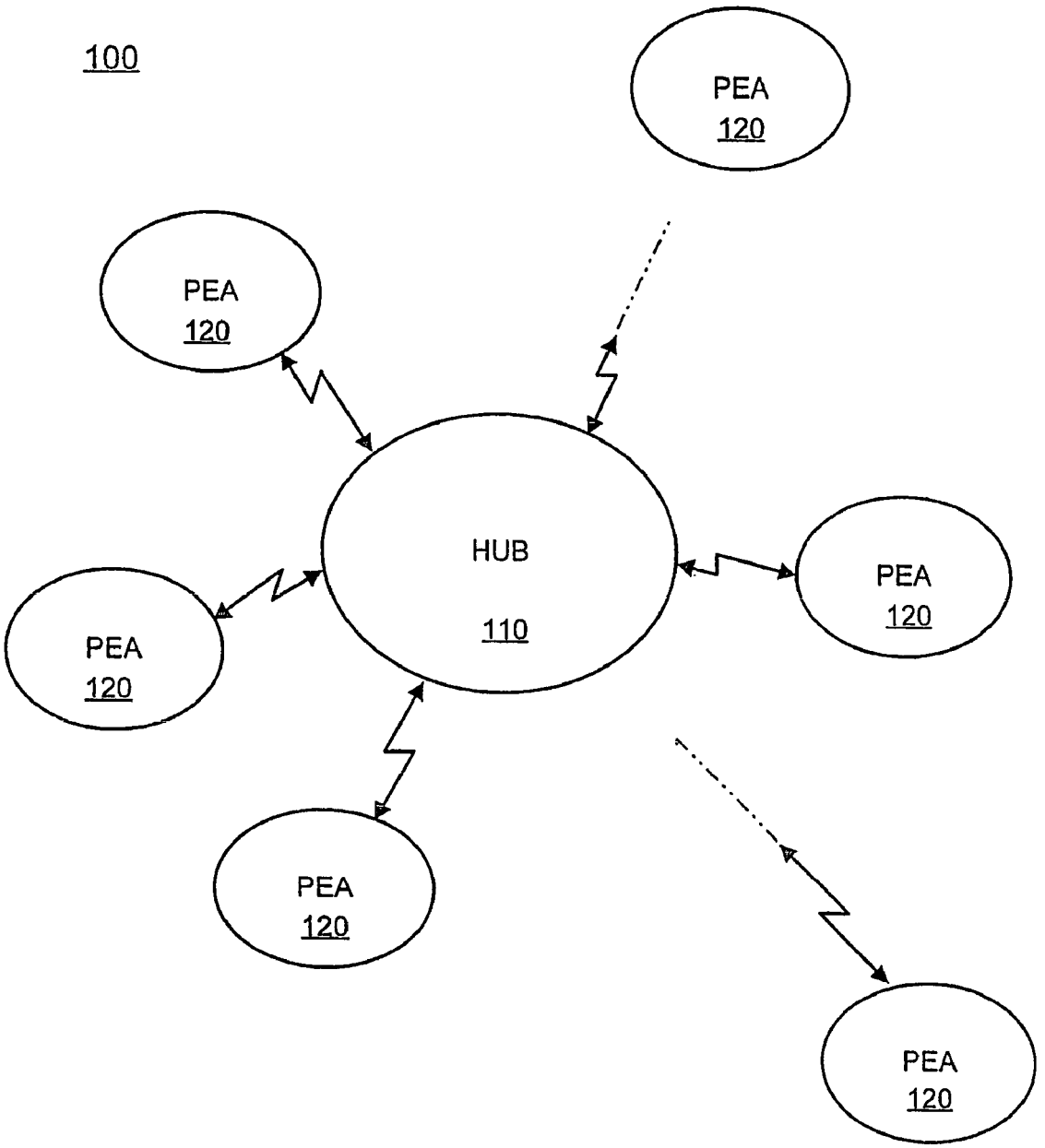

FIG. 1

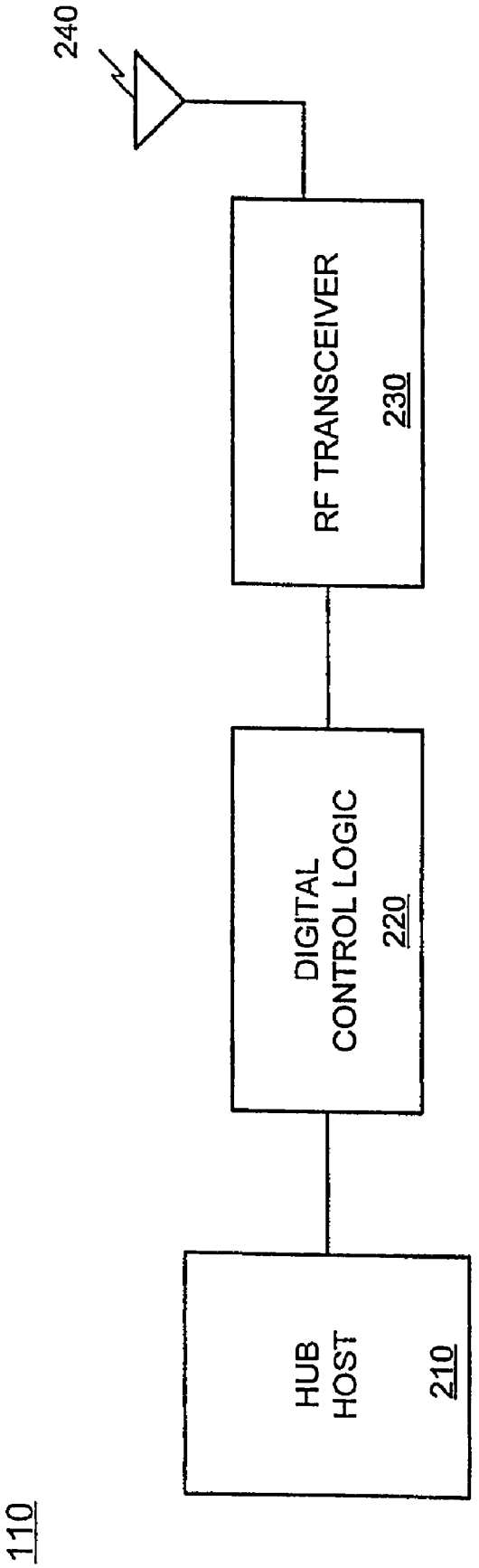
240
RF TRANSCEIVER
230
DIGITAL
CONTROL LOGIC
220
HUB
HOST
210
110

FIG. 2

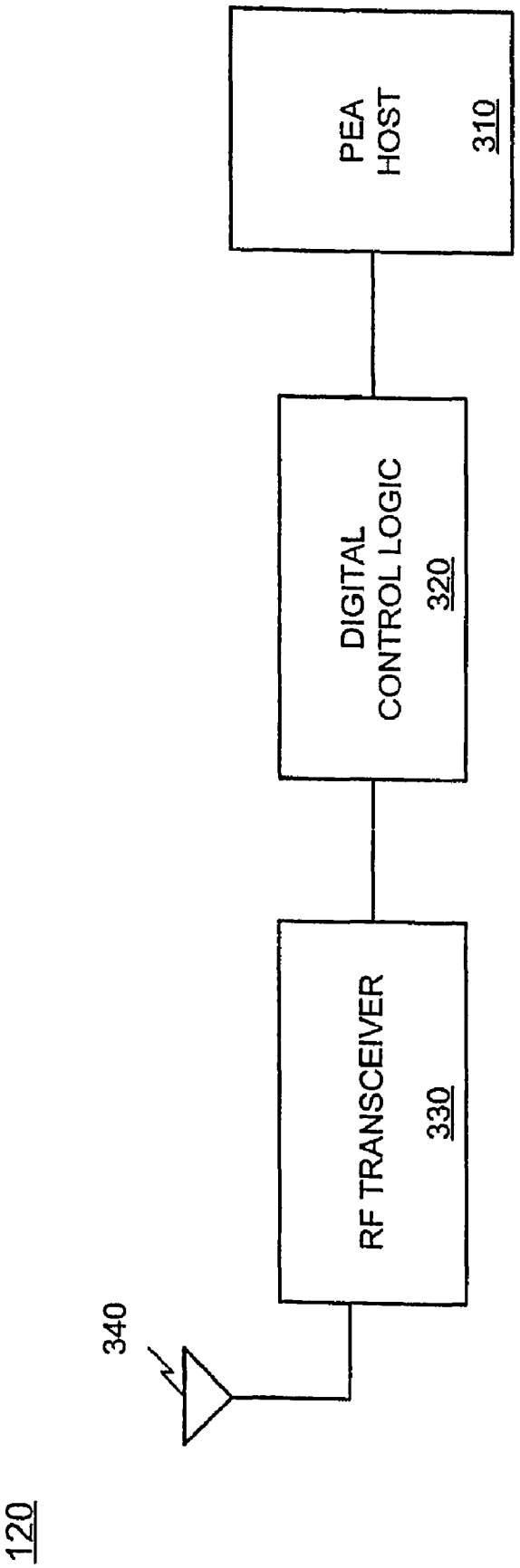
PEA HOST 310
DIGITAL CONTROL LOGIC 320
RF TRANSCEIVER 330
340
120

FIG. 3

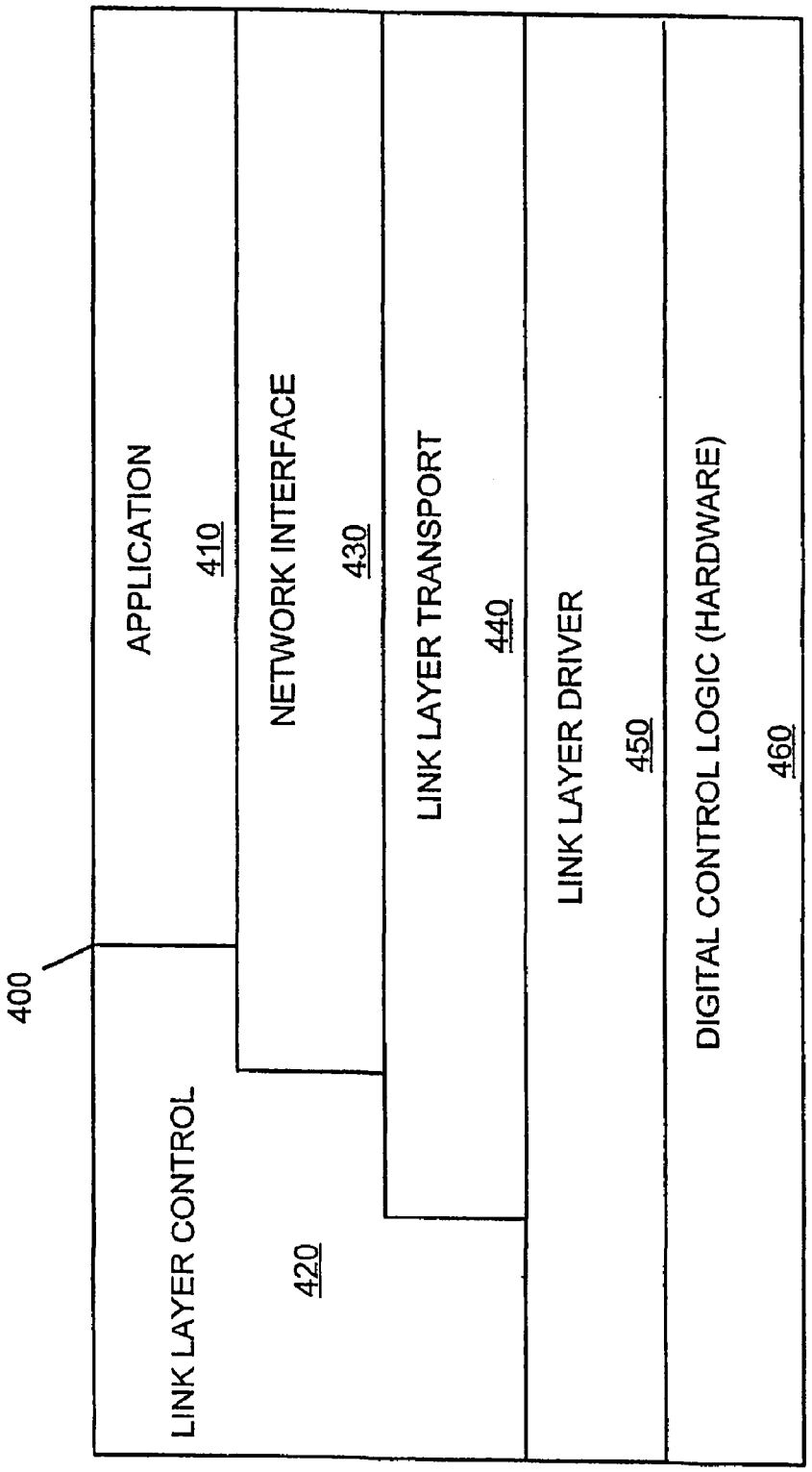
400
APPLICATION
410
NETWORK INTERFACE
430
LINK LAYER TRANSPORT
440
LINK LAYER DRIVER
450
DIGITAL CONTROL LOGIC (HARDWARE)
460
LINK LAYER CONTROL
420

FIG. 4

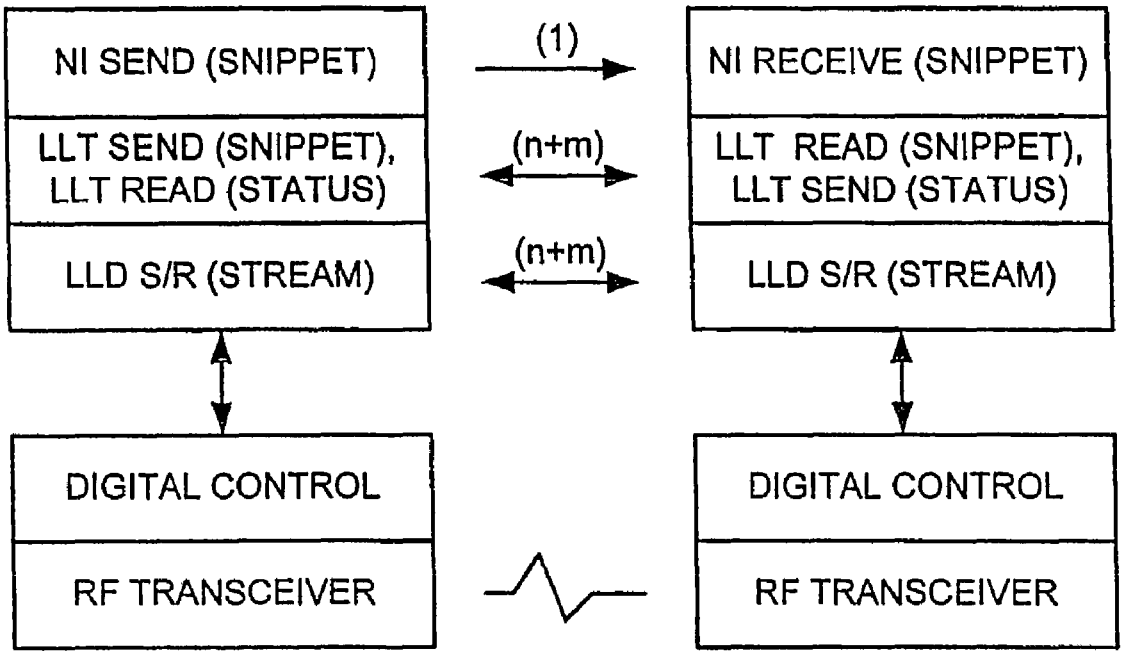
NI SEND (SNIPPET)
LLT SEND (SNIPPET), LLT READ (STATUS)
LLD S/R (STREAM)
DIGITAL CONTROL
RF TRANSCEIVER
(1)
(n+m)
(n+m)
NI RECEIVE (SNIPPET)
LLT READ (SNIPPET), LLT SEND (STATUS)
LLD S/R (STREAM)
DIGITAL CONTROL
RF TRANSCEIVER

FIG. 5

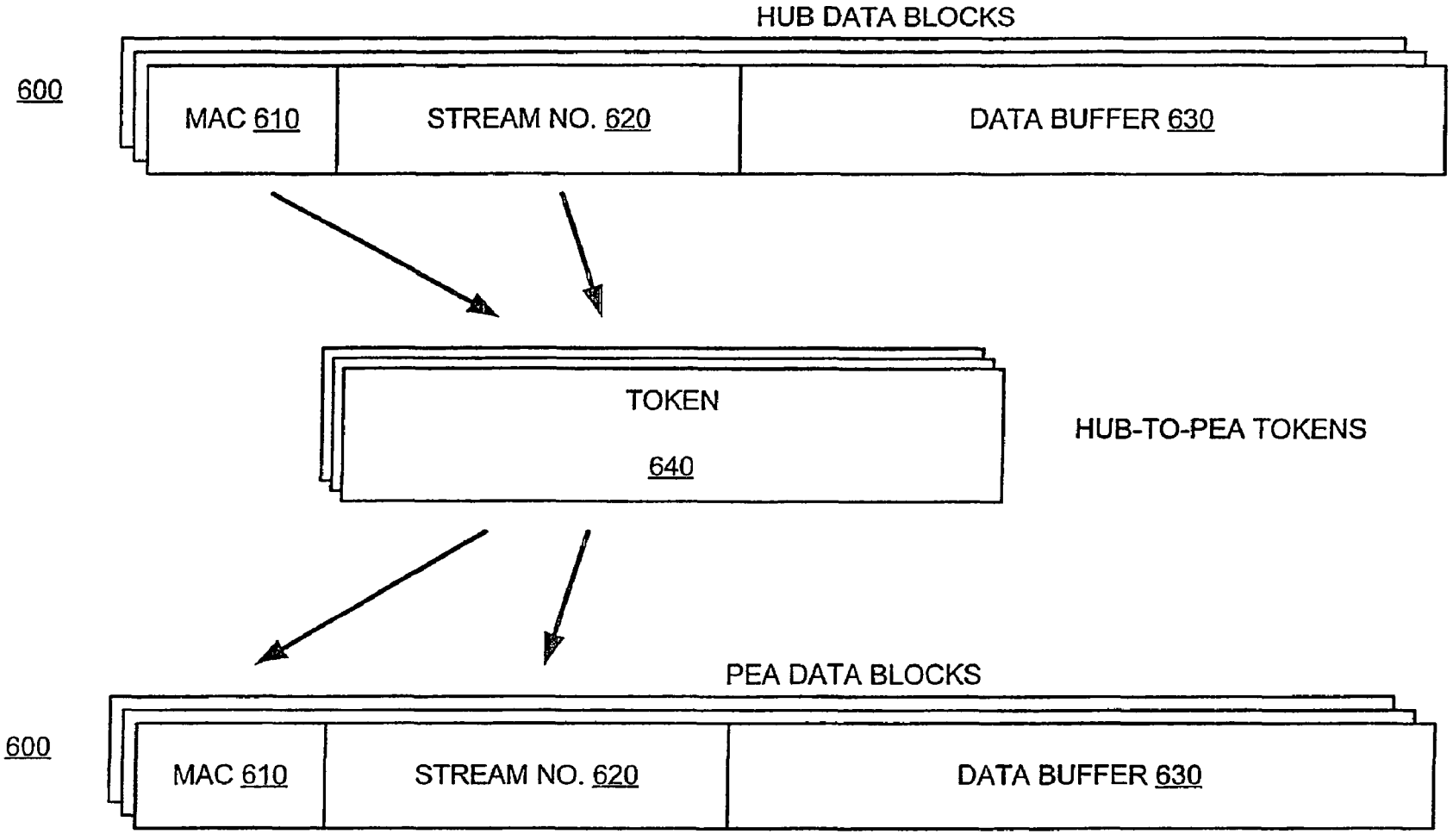
HUB DATA BLOCKS
600
MAC 610
STREAM NO. 620
DATA BUFFER 630
TOKEN
640
HUB-TO-PEA TOKENS
PEA DATA BLOCKS
600
MAC 610
STREAM NO. 620
DATA BUFFER 630

FIG. 6

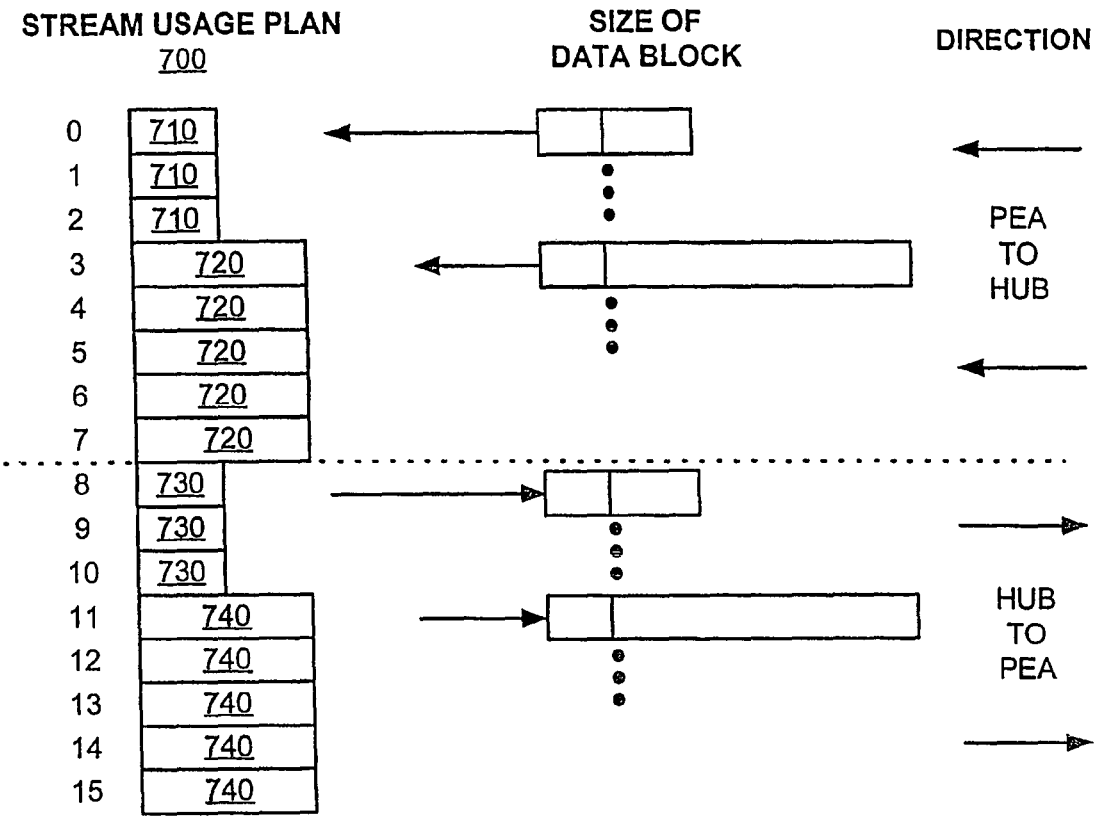
STREAM USAGE PLAN
700
SIZE OF
DATA BLOCK
DIRECTION
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
710
710
710
720
720
720
720
720
730
730
730
740
740
740
740
740
PEA
TO
HUB
HUB
TO
PEA

FIG. 7A

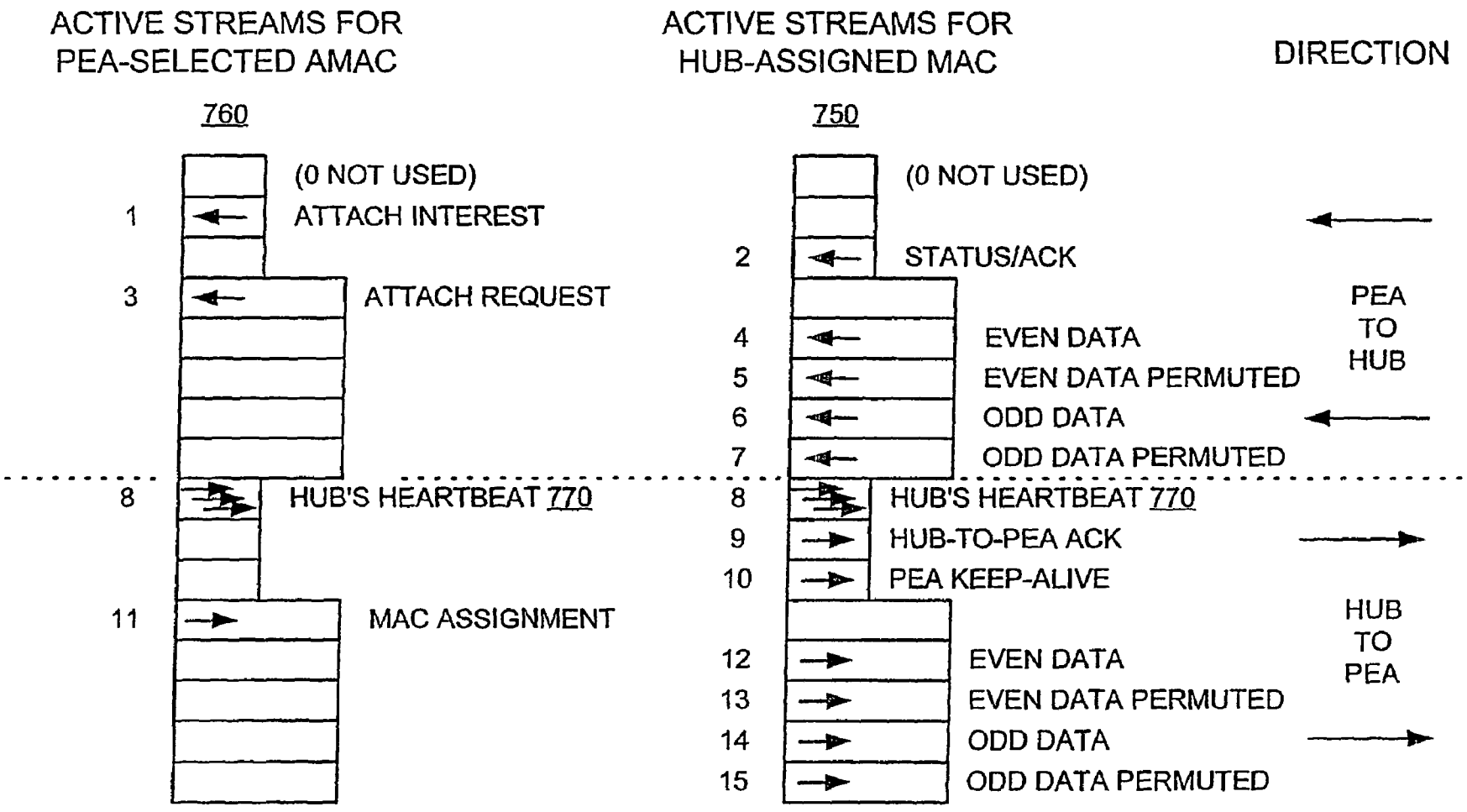
ACTIVE STREAMS FOR PEA-SELECTED AMAC
760
(0 NOT USED)
1
ATTACH INTEREST
3
ATTACH REQUEST
8
HUB'S HEARTBEAT 770
11
MAC ASSIGNMENT
ACTIVE STREAMS FOR HUB-ASSIGNED MAC
750
(0 NOT USED)
2
STATUS/ACK
4
EVEN DATA
5
EVEN DATA PERMUTED
6
ODD DATA
7
ODD DATA PERMUTED
8
HUB'S HEARTBEAT 770
9
HUB-TO-PEA ACK
10
PEA KEEP-ALIVE
12
EVEN DATA
13
EVEN DATA PERMUTED
14
ODD DATA
15
ODD DATA PERMUTED
DIRECTION
PEA TO HUB
HUB TO PEA

FIG. 7B

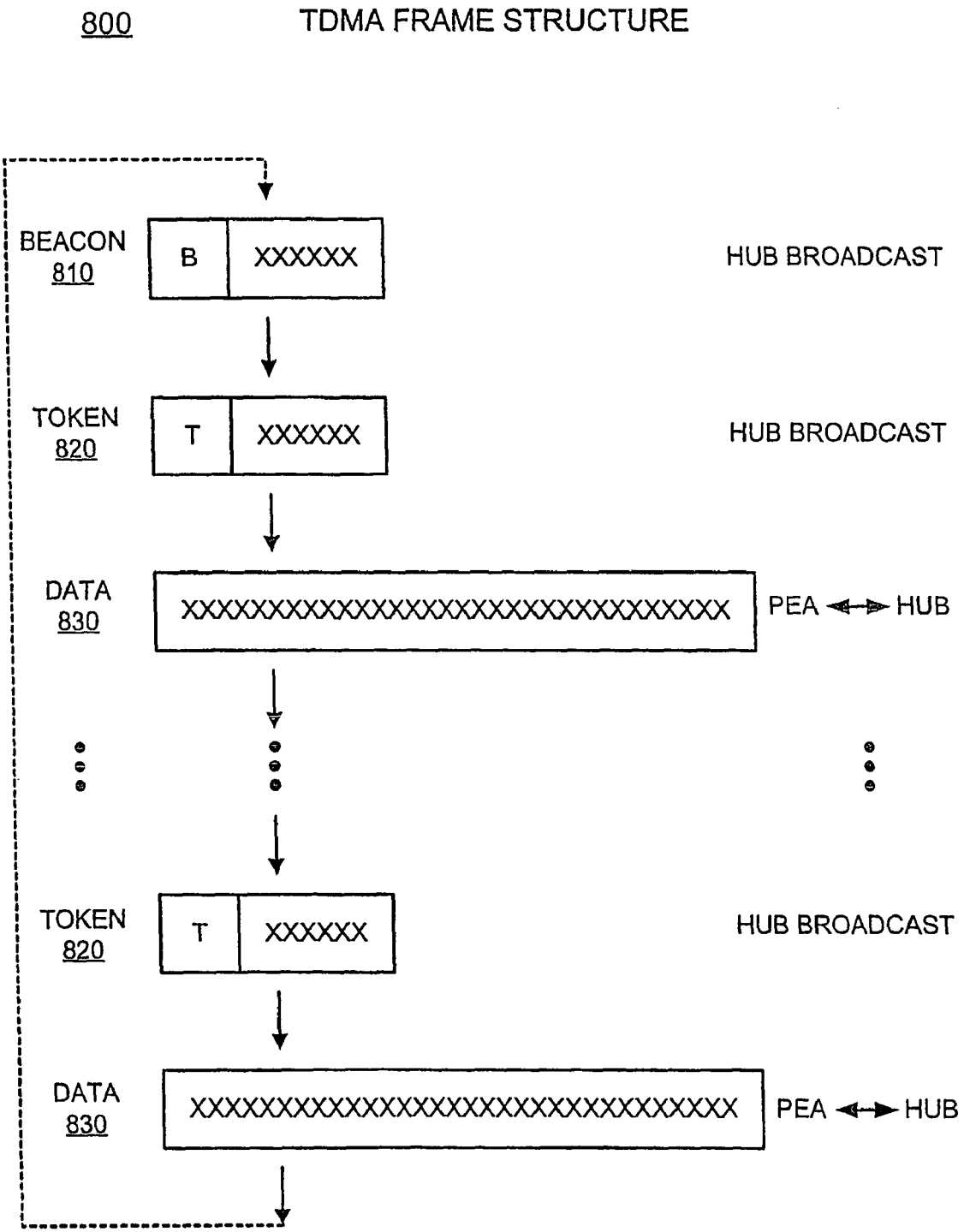
800
TDMA FRAME STRUCTURE
BEACON
810
B
XXXXXX
HUB BROADCAST
TOKEN
820
T
XXXXXX
HUB BROADCAST
DATA
830
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
PEA ↔ HUB
TOKEN
820
T
XXXXXX
HUB BROADCAST
DATA
830
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
PEA ↔ HUB

FIG. 8

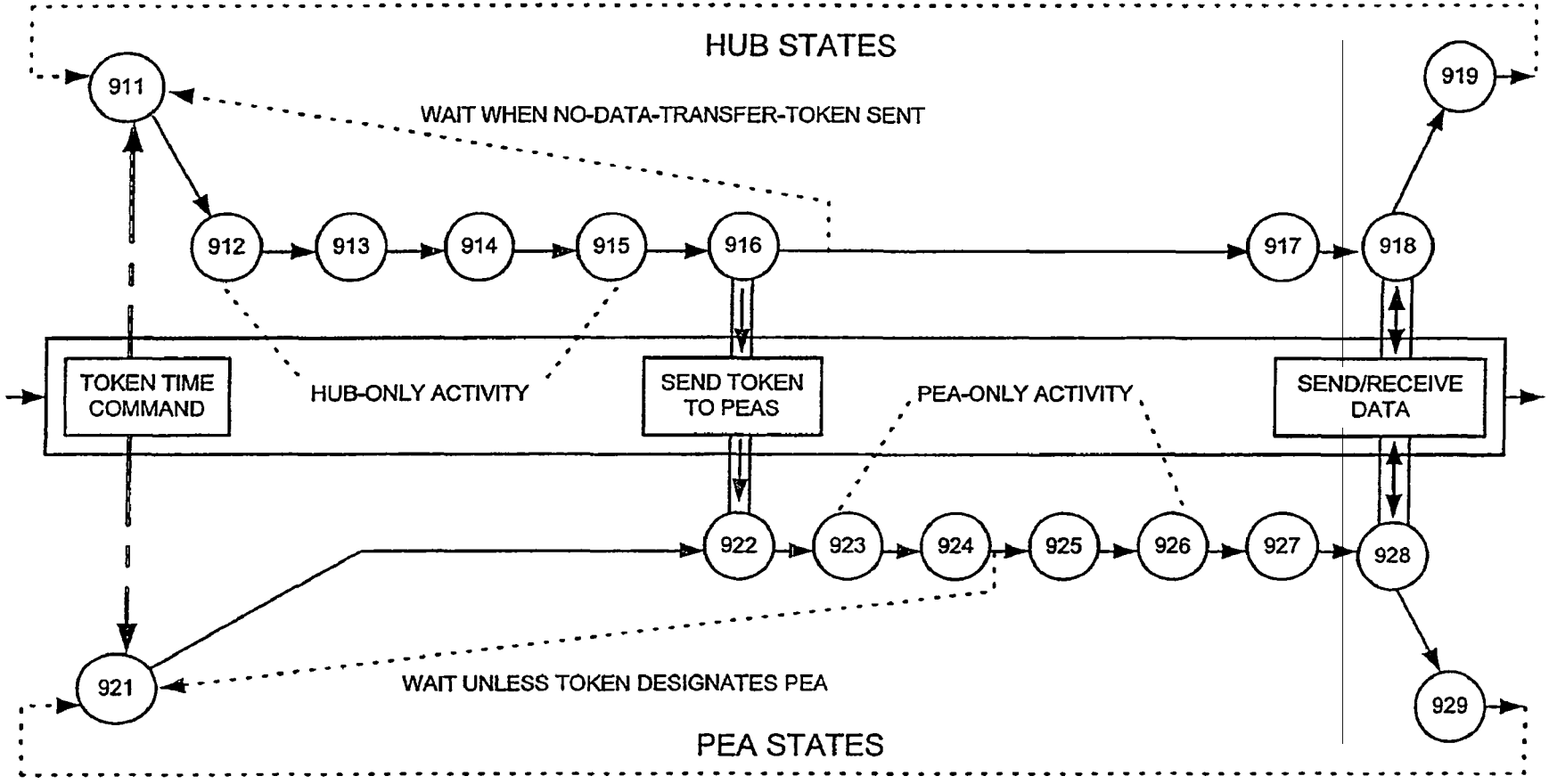
HUB STATES
911
WAIT WHEN NO-DATA-TRANSFER-TOKEN SENT
912
913
914
915
916
917
918
919
TOKEN TIME COMMAND
HUB-ONLY ACTIVITY
SEND TOKEN TO PEAS
PEA-ONLY ACTIVITY
SEND/RECEIVE DATA
922
923
924
925
926
927
928
921
WAIT UNLESS TOKEN DESIGNATES PEA
929
PEA STATES

FIG. 9A

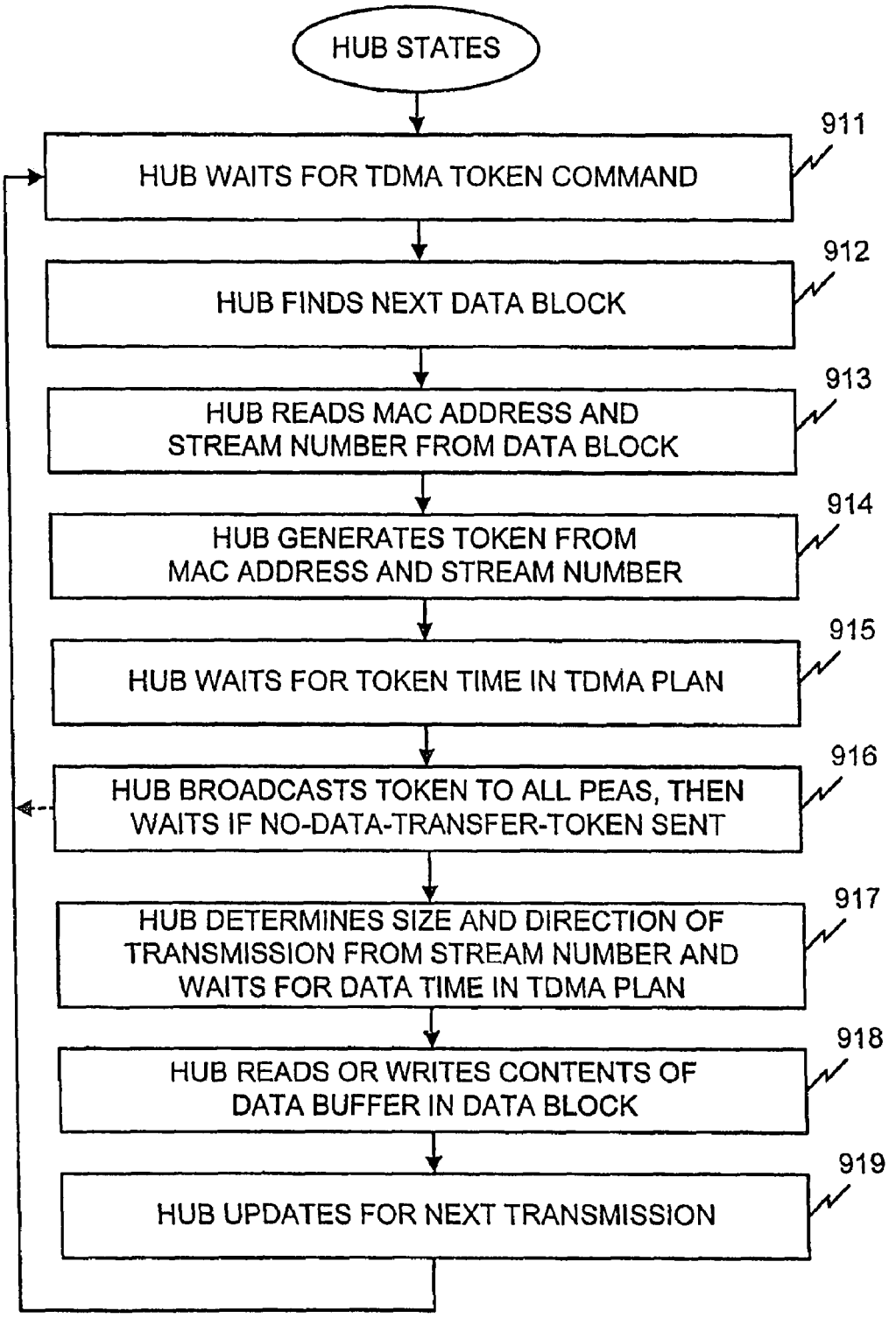
HUB STATES
911
HUB WAITS FOR TDMA TOKEN COMMAND
912
HUB FINDS NEXT DATA BLOCK
913
HUB READS MAC ADDRESS AND STREAM NUMBER FROM DATA BLOCK
914
HUB GENERATES TOKEN FROM MAC ADDRESS AND STREAM NUMBER
915
HUB WAITS FOR TOKEN TIME IN TDMA PLAN
916
HUB BROADCASTS TOKEN TO ALL PEAS, THEN WAITS IF NO-DATA-TRANSFER-TOKEN SENT
917
HUB DETERMINES SIZE AND DIRECTION OF TRANSMISSION FROM STREAM NUMBER AND WAITS FOR DATA TIME IN TDMA PLAN
918
HUB READS OR WRITES CONTENTS OF DATA BUFFER IN DATA BLOCK
919
HUB UPDATES FOR NEXT TRANSMISSION

FIG. 9B

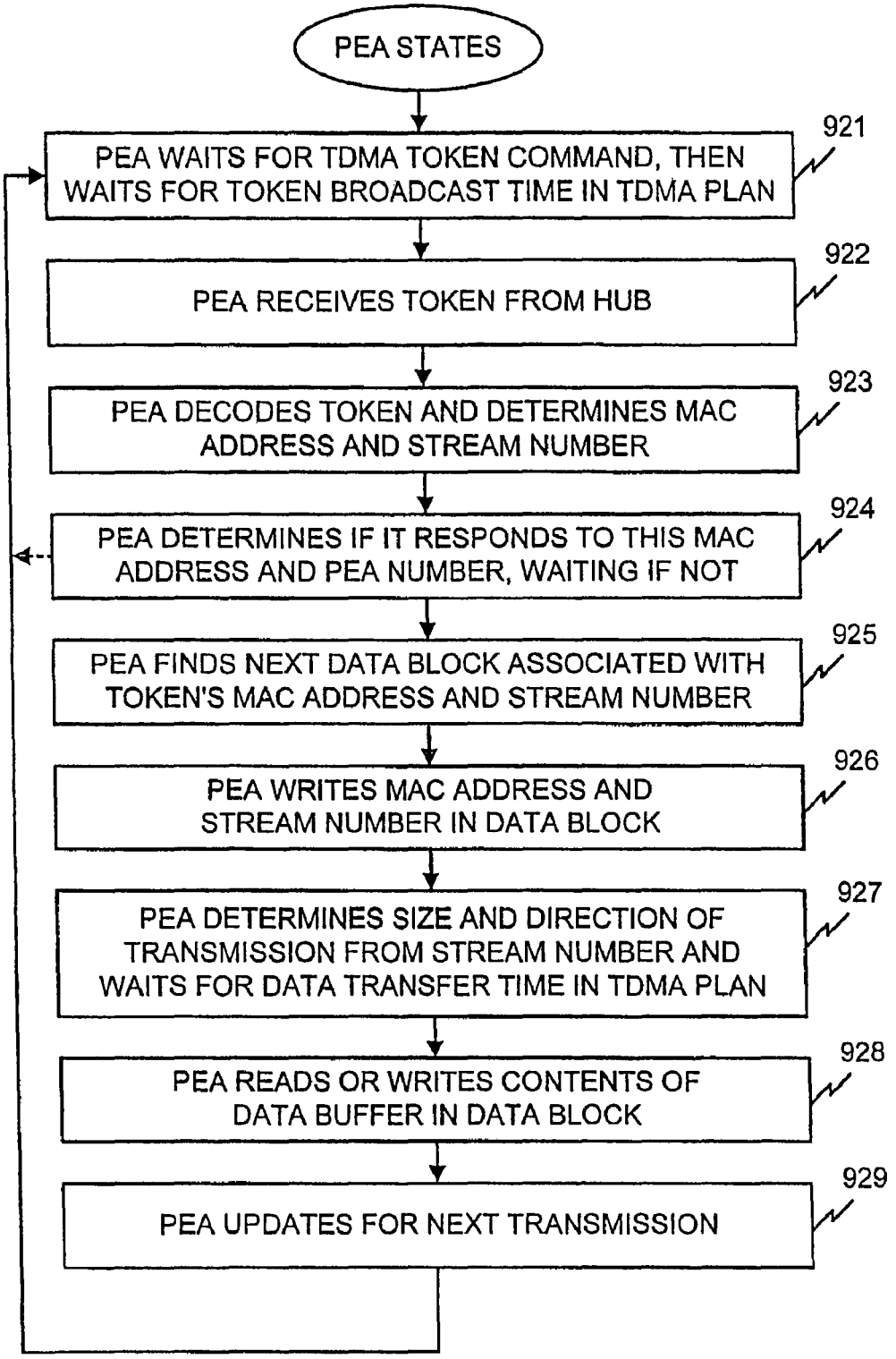
PEA STATES
PEA WAITS FOR TDMA TOKEN COMMAND, THEN WAITS FOR TOKEN BROADCAST TIME IN TDMA PLAN
921
PEA RECEIVES TOKEN FROM HUB
922
PEA DECODES TOKEN AND DETERMINES MAC ADDRESS AND STREAM NUMBER
923
PEA DETERMINES IF IT RESPONDS TO THIS MAC ADDRESS AND PEA NUMBER, WAITING IF NOT
924
PEA FINDS NEXT DATA BLOCK ASSOCIATED WITH TOKEN'S MAC ADDRESS AND STREAM NUMBER
925
PEA WRITES MAC ADDRESS AND STREAM NUMBER IN DATA BLOCK
926
PEA DETERMINES SIZE AND DIRECTION OF TRANSMISSION FROM STREAM NUMBER AND WAITS FOR DATA TRANSFER TIME IN TDMA PLAN
927
PEA READS OR WRITES CONTENTS OF DATA BUFFER IN DATA BLOCK
928
PEA UPDATES FOR NEXT TRANSMISSION
929

FIG. 9C

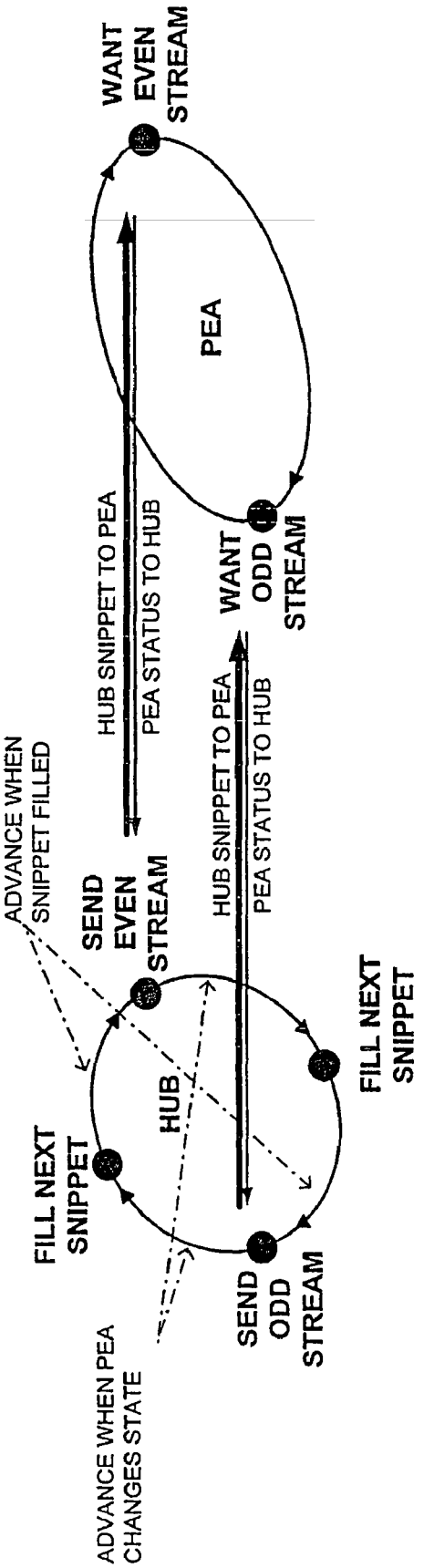

FIG. 10A

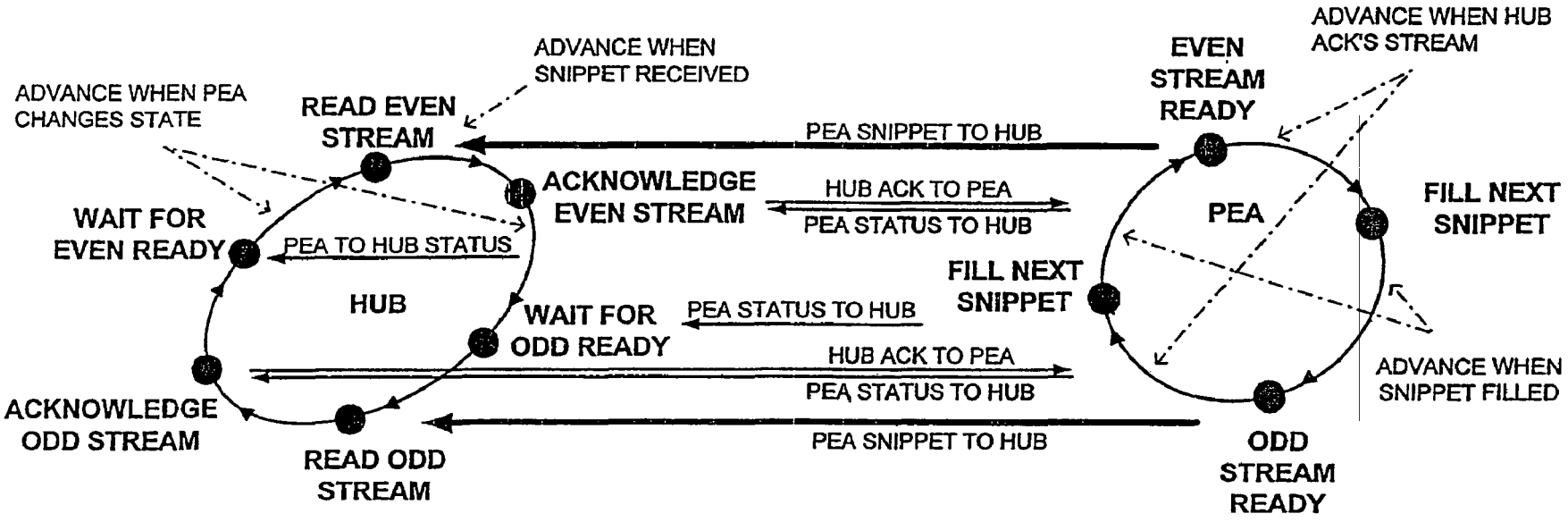
ADVANCE WHEN PEA CHANGES STATE
READ EVEN STREAM
ADVANCE WHEN SNIPPET RECEIVED
PEA SNIPPET TO HUB
EVEN STREAM READY
ADVANCE WHEN HUB ACK'S STREAM
ACKNOWLEDGE EVEN STREAM
HUB ACK TO PEA
PEA STATUS TO HUB
PEA
FILL NEXT SNIPPET
WAIT FOR EVEN READY
PEA TO HUB STATUS
HUB
FILL NEXT SNIPPET
WAIT FOR ODD READY
PEA STATUS TO HUB
HUB ACK TO PEA
PEA STATUS TO HUB
ADVANCE WHEN SNIPPET FILLED
ACKNOWLEDGE ODD STREAM
READ ODD STREAM
PEA SNIPPET TO HUB
ODD STREAM READY

FIG. 10B

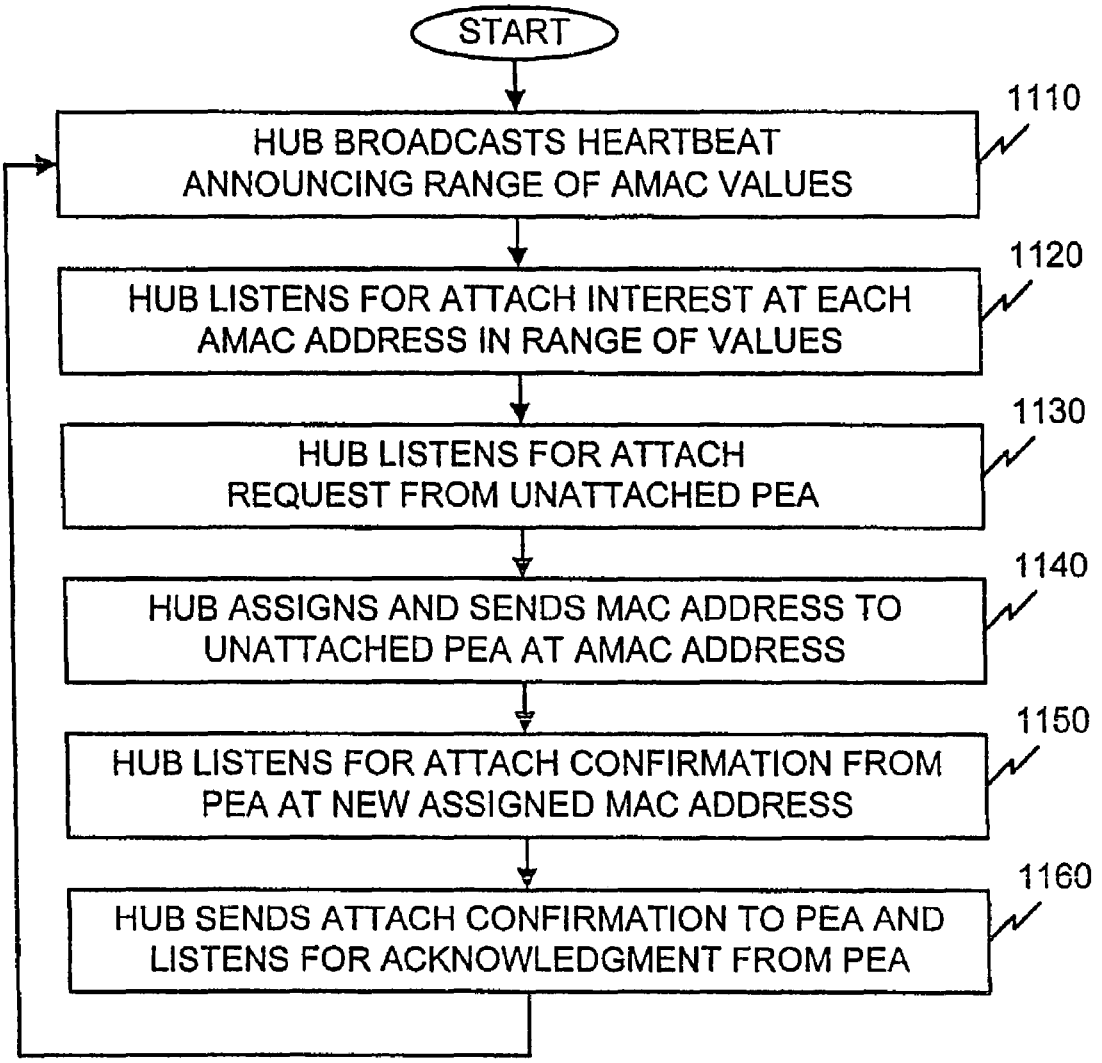
START
HUB BROADCASTS HEARTBEAT ANNOUNCING RANGE OF AMAC VALUES
1110
HUB LISTENS FOR ATTACH INTEREST AT EACH AMAC ADDRESS IN RANGE OF VALUES
1120
HUB LISTENS FOR ATTACH REQUEST FROM UNATTACHED PEA
1130
HUB ASSIGNS AND SENDS MAC ADDRESS TO UNATTACHED PEA AT AMAC ADDRESS
1140
HUB LISTENS FOR ATTACH CONFIRMATION FROM PEA AT NEW ASSIGNED MAC ADDRESS
1150
HUB SENDS ATTACH CONFIRMATION TO PEA AND LISTENS FOR ACKNOWLEDGMENT FROM PEA
1160

FIG. 11

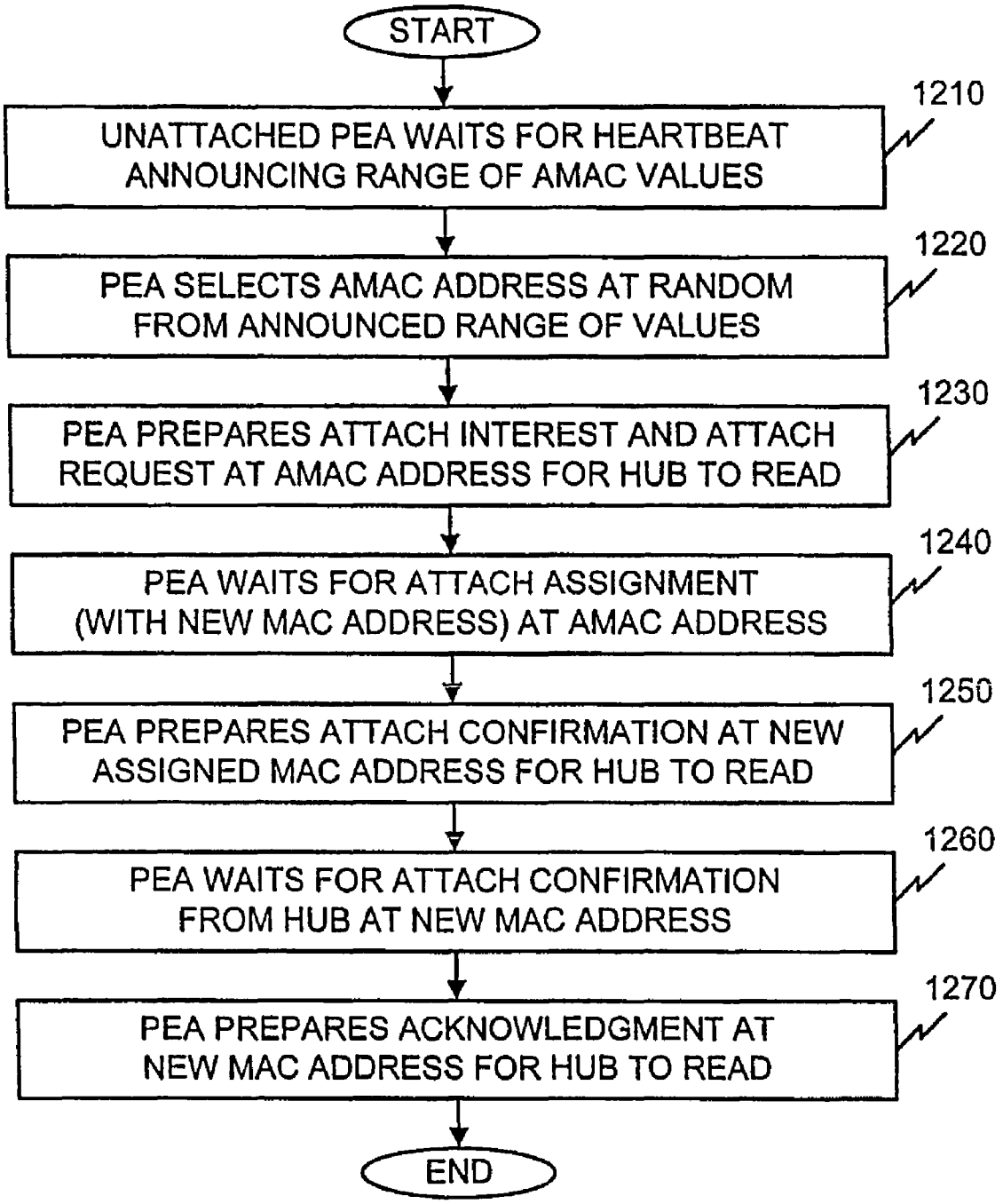
START
1210
UNATTACHED PEA WAITS FOR HEARTBEAT ANNOUNCING RANGE OF AMAC VALUES
1220
PEA SELECTS AMAC ADDRESS AT RANDOM FROM ANNOUNCED RANGE OF VALUES
1230
PEA PREPARES ATTACH INTEREST AND ATTACH REQUEST AT AMAC ADDRESS FOR HUB TO READ
1240
PEA WAITS FOR ATTACH ASSIGNMENT (WITH NEW MAC ADDRESS) AT AMAC ADDRESS
1250
PEA PREPARES ATTACH CONFIRMATION AT NEW ASSIGNED MAC ADDRESS FOR HUB TO READ
1260
PEA WAITS FOR ATTACH CONFIRMATION FROM HUB AT NEW MAC ADDRESS
1270
PEA PREPARES ACKNOWLEDGMENT AT NEW MAC ADDRESS FOR HUB TO READ
END

FIG. 12

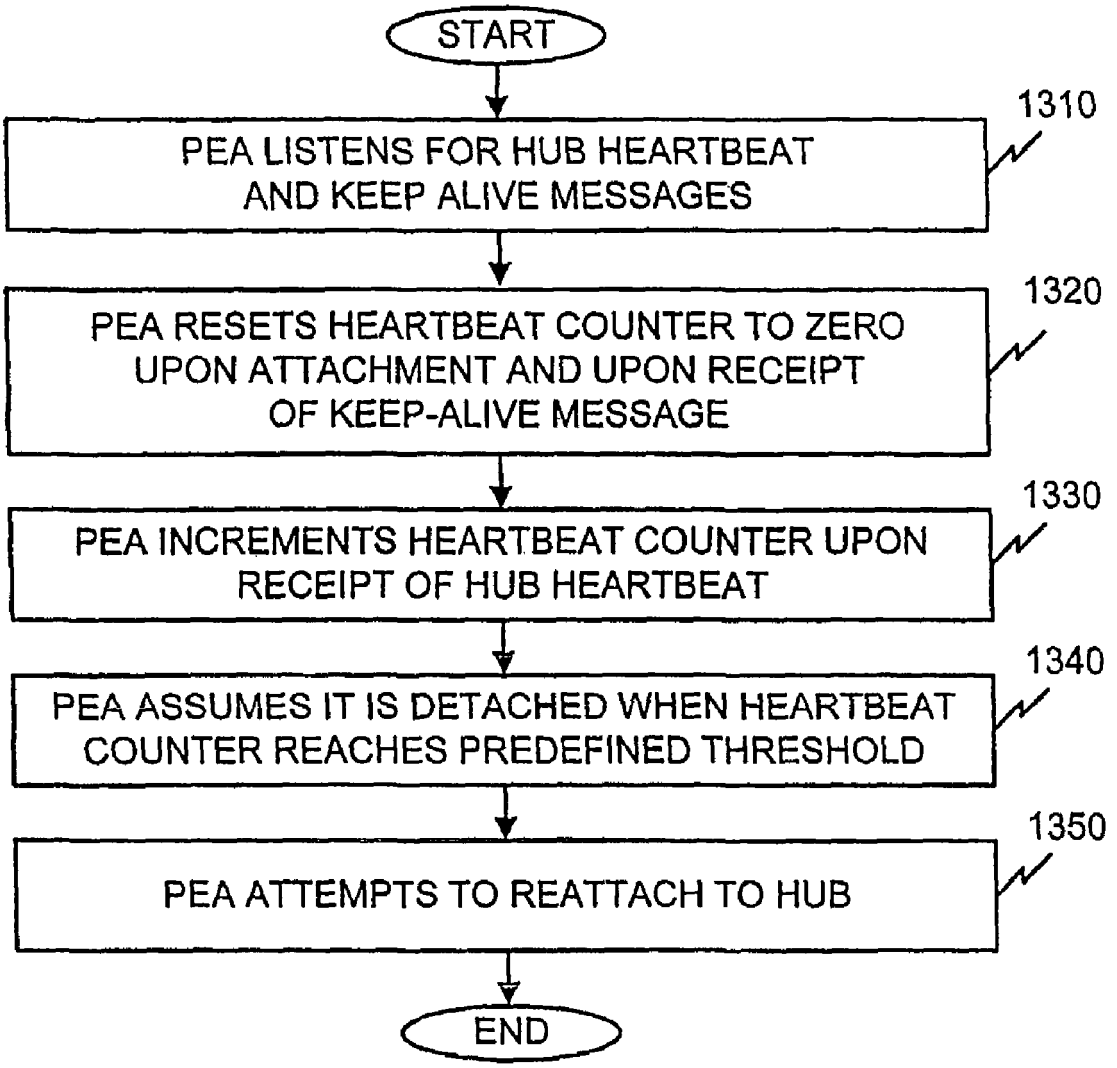
START
PEA LISTENS FOR HUB HEARTBEAT AND KEEP ALIVE MESSAGES
1310
PEA RESETS HEARTBEAT COUNTER TO ZERO UPON ATTACHMENT AND UPON RECEIPT OF KEEP-ALIVE MESSAGE
1320
PEA INCREMENTS HEARTBEAT COUNTER UPON RECEIPT OF HUB HEARTBEAT
1330
PEA ASSUMES IT IS DETACHED WHEN HEARTBEAT COUNTER REACHES PREDEFINED THRESHOLD
1340
PEA ATTEMPTS TO REATTACH TO HUB
1350
END

FIG. 13

PERSONAL AREA NETWORK WITH AUTOMATIC ATTACHMENT AND DETACHMENT

RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 10/894,406 filed on Jul. 19, 2004, which is a continuation of U.S. patent application Ser. No. 09/535,591 filed on Mar. 27, 2000, now U.S. Pat. No. 6,804,232, which is related to U.S. patent application Ser. No. 09/536,191 filed on Mar. 27, 2000, all of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

A. Field of the Invention

The present invention relates to a data network and, more particularly, to a star data network that facilitates bidirectional wireless data communications between a main processor unit and a varying number of peripheral units as they become located within the proximity of the processor unit.

B. Description of Related Art

Over the last decade, the size and power consumption of digital electronic devices has been progressively reduced. For example, personal computers have evolved from lap tops and notebooks into hand-held or belt-carriable devices commonly referred to as personal digital assistants (PDAs). One area of carriable devices that has remained troublesome, however, is the coupling of peripheral devices or sensors to the main processing unit of the PDA. Generally, such coupling is performed through the use of connecting cables. The connecting cables restrict the handling of a peripheral in such a manner as to lose many of the advantages inherent in the PDA's small size and light weight. For a sensor, for example, that occasionally comes into contact with the PDA, the use of cables is particularly undesirable.

While some conventional systems have proposed linking a keyboard or a mouse to a main processing unit using infrared or radio frequency (RF) communications, such systems have typically been limited to a single peripheral unit with a dedicated channel of low capacity.

Based on the foregoing, it is desirable to develop a low power data network that provides highly reliable bidirectional data communication between a host or server processor unit and a varying number of peripheral units and/or sensors while avoiding interference from nearby similar systems.

SUMMARY OF THE INVENTION

Systems and methods consistent with the present invention address this need by providing a wireless personal area network that permits a host unit to communicate with peripheral units with minimal interference from neighboring systems.

A system consistent with the present invention includes a hub device and at least one unattached peripheral device. The unattached peripheral device transmits an attach request to the hub device with a selected address, receives a new address from the hub device to identify the unattached peripheral device, and communicates with the hub device using the new address.

In another implementation consistent with the present invention, a method for attaching an unattached peripheral device to a network having a hub device connected to multiple peripheral devices, includes receiving an attach request from the unattached peripheral device, the attach request identifying the unattached peripheral device to the hub device; generating a new address to identify the unattached peripheral device in response to the received attach request; sending the new address to the unattached peripheral device; and sending a confirmation message to the unattached peripheral device using the new address to attach the unattached peripheral device.

In yet another implementation consistent with the present invention, a method for attaching an unattached peripheral device to a network having a hub device connected to a set of peripheral devices, includes transmitting an attach request with a selected address to the hub device; receiving a new address from the hub device to identify the unattached peripheral device; and attaching to the network using the new address.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate an embodiment of the invention and, together with the description, explain the invention. In the drawings:

FIG. **1** is a diagram of a personal area network (PAN) in which systems and methods consistent with the present invention may be implemented;

FIG. **2** is a simplified block diagram of the Hub of FIG. **1**;

FIG. **3** is a simplified block diagram of a PEA of FIG. **1**;

FIG. **4** is a block diagram of a software architecture of a Hub or PEA in an implementation consistent with the present invention;

FIG. **5** is an exemplary diagram of communication processing by the layers of the software architecture of FIG. **4**;

FIG. **6** is an exemplary diagram of a data block architecture within the DCL of the Hub and PEA in an implementation consistent with the present invention;

FIG. **7**A is a detailed diagram of an exemplary stream usage plan in an implementation consistent with the present invention;

FIG. **7**B is a detailed diagram of an exemplary stream usage assignment in an implementation consistent with the present invention;

FIG. **8** is an exemplary diagram of a time division multiple access (TDMA) frame structure in an implementation consistent with the present invention;

FIG. **9**A is a detailed diagram of activity within the Hub and PEA according to a TDMA plan consistent with the present invention;

FIG. **9**B is a flowchart of the Hub activity of FIG. **9**A;

FIG. **9**C is a flowchart of the PEA activity of FIG. **9**A;

FIGS. **10**A and **10**B are high-level diagrams of states that the Hub and PEA traverse during a data transfer in an implementation consistent with the present invention;

FIGS. **11** and **12** are flowcharts of Hub and PEA attachment processing, respectively, consistent with the present invention; and

FIG. **13** is a flowchart of PEA detachment and reattachment processing consistent with the present invention.

DETAILED DESCRIPTION

The following detailed description of the invention refers to the accompanying drawings. The same reference numbers in different drawings identify the same or similar elements. Also, the following detailed description does not limit the invention. Instead, the scope of the invention is defined by the appended claims.

Systems and methods consistent with the present invention provide a wireless personal area network that permits a host

device to communicate with a varying number of peripheral devices with minimal interference from neighboring networks. The host device uses tokens to manage all of the communication in the network, and automatic attachment and detachment mechanisms to communicate with the peripheral devices.

Network Overview

A Personal Area Network (PAN) is a local network that interconnects computers with devices (e.g., peripherals, sensors, actuators) within their immediate proximity. These devices may be located nearby and may frequently or occasionally come within range and go out of range of the computer. Some devices may be embedded within an infrastructure (e.g., a building or vehicle) so that they can become part of a PAN as needed.

A PAN, in an implementation consistent with the present invention, has low power consumption and small size, supports wireless communication without line-of-sight limitations, supports communication among networks of multiple devices (over 100 devices), and tolerates interference from other PAN systems operating within the vicinity. A PAN can also be easily integrated into a broad range of simple and complex devices, is low in cost, and is capable of being used worldwide.

FIG. **1** is a diagram of a PAN **100** consistent with the present invention. The PAN **100** includes a single Hub device **110** surrounded by multiple Personal Electronic Accessory (PEA) devices **120** configured in a star topology. Other topologies may also be possible. Each device is identified by a Media Access (MAC) address.

The Hub **110** orchestrates all communication in the PAN **100**, which consists of communication between the Hub **110** and one or more PEA(s) **120**. The Hub **110** manages the timing of the network, allocates available bandwidth among the currently attached PEAs **120** participating in the PAN **100**, and supports the attachment, detachment, and reattachment of PEAs **120** to and from the PAN **100**.

The Hub **110** may be a stationary device or may reside in some sort of wearable computer, such as a simple pager-like device, that may move from peripheral to peripheral. The Hub **110** could, however, include other devices.

The PEAs **120** may vary dramatically in terms of their complexity. A very simple PEA might include a movement sensor having an accelerometer, an 8-bit microcontroller, and a PAN interface. An intermediate PEA might include a bar code scanner and its microcontroller. More complex PEAs might include PDAs, cellular telephones, or even desktop PCs and workstations. The PEAs may include stationary devices located near the Hub and/or portable devices that move to and away from the Hub.

The Hub **110** and PEAs **120** communicate using multiplexed communication over a predefined set of streams. Logically, a stream is a one-way communications link between one PEA **120** and its Hub **110**. Each stream has a predetermined size and direction. The Hub **110** uses stream numbers to identify communication channels for specific functions (e.g., data and control).

The Hub **110** uses MAC addresses to identify itself and the PEAs **120**. The Hub **110** uses its own MAC address to broadcast to all PEAs **120**. The Hub **110** might also use MAC addresses to identify virtual PEAs within any one physical PEA **120**. The Hub **110** combines a MAC address and a stream number into a token, which it broadcasts to the PEAs **120** to control communication through the network **100**. The PEA **120** responds to the Hub **110** if it identifies its own MAC address or the Hub MAC address in the token and if the stream number in the token is active for the MAC address of the PEA **120**.

Exemplary Hub Device

FIG. **2** is a simplified block diagram of the Hub **110** of FIG. **1**. The Hub **110** may be a battery-powered device that includes Hub host **210**, digital control logic **220**, radio frequency (RF) transceiver **230**, and an antenna **240**.

Hub host **210** may include anything from a simple microcontroller to a high performance microprocessor. The digital control logic (DCL) **220** may include a controller that maintains timing and coordinates the operations of the Hub host **210** and the RF transceiver **230**. The DCL **220** is specifically designed to minimize power consumption, cost, and size of the Hub **110**. Its design centers around a time-division multiple access (TDMA)-based network access protocol that exploits the short range nature of the PAN **100**. The Hub host **210** causes the DCL **220** to initialize the network **100**, send tokens and messages, and receive messages. Responses from the DCL **220** feed incoming messages to the Hub host **210**.

The RF transceiver **230** includes a conventional RF transceiver that transmits and receives information via the antenna **240**. The RF transceiver **230** may alternatively include separate transmitter and receiver devices controlled by the DCL **220**. The antenna **240** includes a conventional antenna for transmitting and receiving information over the network.

While FIG. **2** shows the exemplary Hub **110** as consisting of three separate elements, these elements may be physically implemented in one or more integrated circuits. For example, the Hub host **210** and the DCL **220**, the DCL **220** and the RF transceiver **230**, or the Hub host **210**, the DCL **220**, and the RF transceiver **230** may be implemented as a single integrated circuit or separate integrated circuits. Moreover, one skilled in the art will recognize that the Hub **110** may include additional elements that aid in the sending, receiving, and processing of data.

Exemplary Pea Device

FIG. **3** is a simplified block diagram of the PEA **120**. The PEA **120** may be a battery-powered device that includes a PEA host **310**, DCL **320**, RF transceiver **330**, and an antenna **340**. The PEA host **310** may include a sensor that responds to information from a user, an actuator that provides output to the user, a combination of a sensor and an actuator, or more complex circuitry, as described above.

The DCL **320** may include a controller that coordinates the operations of the PEA host **310** and the RF transceiver **330**. The DCL **320** sequences the operations necessary in establishing synchronization with the Hub **110**, in data communications, in coupling received information from the RF transceiver **330** to the PEA host **310**, and in transmitting data from the PEA host **310** back to the Hub **110** through the RF transceiver **330**.

The RF transceiver **330** includes a conventional RF transceiver that transmits and receives information via the antenna **340**. The RF transceiver **330** may alternatively include separate transmitter and receiver devices controlled by the DCL **320**. The antenna **340** includes a conventional antenna for transmitting and receiving information over the network.

While FIG. **3** shows the exemplary PEA **120** as consisting of three separate elements, these elements may be physically implemented in one or more integrated circuits. For example, the PEA host **310** and the DCL **320**, the DCL **320** and the RF transceiver **330**, or the PEA host **310**, the DCL **320**, and the

RF transceiver **330** may be implemented as a single integrated circuit or separate integrated circuits. Moreover, one skilled in the art will recognize that the PEA **120** may include additional elements that aid in the sending, receiving, and processing of data.

Exemplary Software Architecture

FIG. **4** is an exemplary diagram of a software architecture **400** of the Hub **110** in an implementation consistent with the present invention. The software architecture **400** in the PEA **120** has a similar structure. The software architecture **400** includes several distinct layers, each designed to serve a specific purpose, including: (1) application **410**, (2) link layer control (LLC) **420**, (3) network interface (NI) **430**, (4) link layer transport (LLT) **440**, (5) link layer driver (LLD) **450**, and (6) DCL hardware **460**. The layers have application programming interfaces (APIs) to facilitate communication with lower layers. The LLD **450** is the lowest layer of software. Each layer may communicate with the next higher layer via procedural upcalls that the higher layer registers with the lower layer.

The application **410** may include any application executing on the Hub **110**, such as a communication routine. The LLC **420** performs several miscellaneous tasks, such as initialization, attachment support, bandwidth control, and token planning. The LLC **420** orchestrates device initialization, including the initialization of the other layers in the software architecture **400**, upon power-up.

The LLC **420** provides attachment support by providing attachment opportunities for unattached PEAs to attach to the Hub **110** so that they can communicate, providing MAC address assignment, and initializing an NI **430** and the layers below it for communication with a PEA **120**. The LLC **420** provides bandwidth control through token planning. Through the use of tokens, the LLC **420** allocates bandwidth to permit one PEA **120** at a time to communicate with the Hub **110**.

The NI **430** acts on its own behalf, or for an application **410** layer above it, to deliver data to the LLT **440** beneath it. The LLT **440** provides an ordered, reliable "snippet" (i.e., a data block) delivery service for the NI **430** through the use of encoding (e.g., 16-64 bytes of data plus a cyclic redundancy check (CRC)) and snippet retransmission. The LLT **440** accepts snippets, in order, from the NI **430** and delivers them using encoded status blocks (e.g., up to 2 bytes of status information translated through Forward Error Correction (FEC) into 6 bytes) for acknowledgments (ACKs).

The LLD **450** is the lowest level of software in the software architecture **400**. The LLD **450** interacts with the DCL hardware **460**. The LLD **450** initializes and updates data transfers via the DCL hardware **460** as it delivers and receives data blocks for the LLT **440**, and processes hardware interrupts. The DCL hardware **460** is the hardware driven by the LLD **450**.

FIG. **5** is an exemplary diagram of communication processing by the layers of the software architecture **400** of FIG. **4**. In FIG. **5**, the exemplary communications involve the transmission of a snippet from one node to another. This example assumes that the sending node is the Hub **110** and the receiving node is a PEA **120**. Processing begins with the NI **430** of the Hub **110** deciding to send one or more bytes (but no more than will fit) in a snippet. The NI **430** exports the semantics that only one transaction is required to transmit these bytes to their destination (denoted by "(1)" in the figure). The NI **430** sends a unique identifier for the destination PEA **120** of the snippet to the LLT **440**. The LLT **440** maps the PEA identifier to the MAC address assigned to the PEA **120** by the Hub **110**.

The LLT **440** transmits the snippet across the network to the receiving device. To accomplish this, the LLT **440** adds header information (to indicate, for example, how many bytes in the snippet are padded bytes) and error checking information to the snippet, and employs reverse-direction status/acknowledgment messages and retransmissions. This is illustrated in FIG. **5** by the bidirectional arrow between the LLT **440** layers marked with "(n+m)." The number n of snippet transmissions and the number m of status transmissions in the reverse direction are mostly a function of the amount of noise in the wireless communication, which may be highly variable. The LLT **440** may also encrypt portions or all of the snippet using known encryption technology.

The LLT **440** uses the LLD **450** to provide a basic block and stream-oriented communications service, isolating the DCL **460** interface from the potentially complex processing required of the LLT **440**. The LLT **440** uses multiple stream numbers to differentiate snippet and status blocks so that the LLD **450** need not know which blocks contain what kind of content. The LLD **450** reads and writes the hardware DCL **460** to trigger the transmission and reception of data blocks. The PEA LLT **440**, through the PEA LLD **450**, instructs the PEA DCL **460** which MAC address or addresses to respond to, and which stream numbers to respond to for each MAC address. The Hub LLT **440**, through the Hub LLD **450**, instructs the Hub DCL **460** which MAC addresses and stream numbers to combine into tokens and transmit so that the correct PEA **120** will respond. The Hub DCL **460** sends and receives (frequently in a corrupted form) the data blocks across the RF network via the Hub RF transceiver **230** (FIG. **2**).

The Hub LLT **440** employs FEC for status, checksums and error checking for snippets, and performs retransmission control for both to ensure that each snippet is delivered reliably to its client (e.g., PEA LLT **440**). The PEA LLT **440** delivers snippets in the same order that they were sent by the Hub NI **430** to the PEA NI **430**. The PEA NI **430** takes the one or more bytes sent in the snippets and delivers them in order to the higher-level application **410**, thereby completing the transmission.

Exemplary DCL Data Block Architecture

FIG. **6** is an exemplary diagram of a data block architecture **600** within the DCL of the Hub **110** and the PEA **120**. The data block **600** contains a MAC address **610** designating a receiving or sending PEA **120**, a stream number **620** for the communication, and a data buffer **630** which is full when sending and empty when receiving. As will be described later, the MAC address **610** and stream number **620** form the contents of a token **640**. When the LLD **450** reads from and writes to the hardware DCL **460**, the LLD **450** communicates the MAC address **610** and stream number **620** with the data-buffer **630**. When a PEA **120** receives a data block, the DCL **460** places the MAC address **610** and stream number **620** contained in the preceding token **640** in the data block **600** to keep track of the different data flows.

Exemplary Stream Architecture

The LLD **450** provides a multi-stream data transfer service for the LLT **440**. While the LLT **440** is concerned with data snippets and status/acknowledgements, the LLD **450** is concerned with the size of data blocks and the direction of data transfers to and from the Hub **110**.

FIG. **7**A is a detailed diagram of an exemplary stream usage plan **700** in an implementation consistent with the

present invention. A single stream usage plan may be predefined and used by the Hub **110** and all PEAs **120**. The PEA **120** may have a different set of active streams for each MAC address it supports, and only responds to a token that specifies a MAC address of the PEA **120** and a stream that is active for that MAC address. In an implementation consistent with the present invention, every PEA **120** may support one or more active Hub-to-PEA streams associated with the Hub's MAC address.

The stream usage plan **700** includes several streams **710**-**740**, each having a predefined size and data transfer direction. The plan **700** may, of course, have more or fewer entries and may accommodate more than the two data block sizes shown in the figure. In the plan **700**, streams **0-2** (**710**) are used to transmit the contents of small data blocks from the PEA **120** to the Hub **110**. Streams **3-7** (**720**) are used to transmit the contents of larger data blocks from the PEA **120** to the Hub **110**. Streams **8-10** (**730**), on the other hand, are used to transmit the contents of small data blocks from the Hub **110** to the PEA **120**. Streams **11-15** (**740**) are used to transmit the contents of larger data blocks from the Hub **110** to the PEA **120**.

To avoid collisions, some of the streams are reserved for PEAs desiring to attach to the network and the rest are reserved for PEAs already attached to the network. With such an arrangement, a PEA **120** knows whether and what type of communication is scheduled by the Hub **110** based on a combination of the MAC address **610** and the stream number **620**.

FIG. **7**B is a detailed diagram of an exemplary stream usage assignment by the LLT **440** in an implementation consistent with the present invention. The LLT **440** assigns different streams to different communication purposes, reserving the streams with small block size for status, and using the streams with larger block size for snippets. For example, the LLT **440** may use four streams (**4-7** and **12-15**) for the transmission of snippets in each direction, two for odd parity snippets and two for even parity snippets. In other implementations consistent with the present invention, the LLT **440** uses different numbers of streams of each parity and direction.

The use of more than one stream for the same snippet allows a snippet to be sent in more than one form. For example, the LLT **440** may send a snippet in its actual form through one stream and in a form with bytes complemented and in reverse order through the other stream. The alternating use of different transformations of a snippet more evenly distributes transmission errors among the bits of the snippet as they are received, and hence facilitates the reconstruction of a snippet from multiple corrupted received versions. The receiver always knows which form of the snippet was transmitted based on its stream number.

The LLT **440** partitions the streams into two disjoint subsets, one for use with Hub **110** assigned MAC addresses **750** and the other for use with attaching PEAs' self-selected MAC addresses (AMACs) **760**. Both the LLT **440** and the LLD **450** know the size and direction of each stream, but the LLT **450** is responsible for determining how the streams are used, how MAC numbers are assigned and used, and assuring that no two PEAs **120** respond to the same token (containing a MAC address and stream number) transmitted by the Hub **110**. One exception to this includes the Hub's use of its MAC address to broadcast its heartbeat **770** (described below) to all PEAs **120**.

Exemplary Communication

FIG. **8** is an exemplary diagram of a TDMA frame structure **800** of a TDMA plan consistent with the present invention. The TDMA frame **800** starts with a beacon **810**, and then alternates token broadcasts **820** and data transfers **830**. The Hub **110** broadcasts the beacon **810** at the start of each TDMA frame **800**. The PEAs **120** use the beacon **810**, which may contain a unique identifier of the Hub **110**, to synchronize to the Hub **110**.

Each token **640** (FIG. **6**) transmitted by the Hub **110** in a token broadcast **820** includes a MAC address **610** (FIG. **6**) and a stream number **620** for the data buffer **630** transfer that follows. The MAC address **610** and stream number **620** in the token **640** together specify a particular PEA **120** to transmit or receive data, or, in the case of the Hub's MAC address **610**, specify no, many, or all PEAs to receive data from the Hub **110** (depending on the stream number). The stream number **620** in the token **640** indicates the direction of the data transfer **830** (Hub **110** to PEA **120** or PEA **120** to Hub **110**), the number of bytes to be transferred, and the data source (for the sender) and the appropriate empty data block (for the receiver).

The TDMA plan controls the maximum number of bytes that can be sent in a data transfer **830**. Not all of the permitted bytes need to be used in the data transfer **830**, however, so the Hub **110** may schedule a status block in the initial segment of a TDMA time interval that is large enough to send a snippet. The Hub **110** and PEA **120** treat any left over bytes as no-ops to mark time. Any PEA **120** not involved in the data transfer uses all of the data transfer **830** bytes to mark time while waiting for the next token **640**. The PEA **120** may also power down non-essential circuitry at this time to reduce power consumption.

FIG. **9**A is an exemplary diagram of communication processing for transmitting a single data block from the Hub **110** to a PEA **120** according to the TDMA plan of FIG. **8**. FIGS. **9**B and **9**C are flowcharts of the Hub **110** and PEA **120** activities, respectively, of FIG. **9**A. The reference numbers in FIG. **9**A correspond to the flowchart steps of FIGS. **9**B and **9**C.

With regard to the Hub activity, the Hub **110** responds to a token command in the TDMA plan [step **911**] (FIG. **9**B) by determining the location of the next data block **600** to send or receive [step **912**]. The Hub **110** reads the block's MAC address **610** and stream number **620** [step **913**] and generates a token **640** from the MAC address and stream number using FEC [step **914**]. The Hub **110** then waits for the time for sending a token **640** in the TDMA plan (i.e., a token broadcast **820** in FIG. **8**) [step **915**] and broadcasts the token **640** to the PEAs **120** [step **916**]. If the stream number **620** in the token **640** is zero (i.e., a NO-DATA-TRANSFER token), no PEA **120** will respond and the Hub **110** waits for the next token command in the TDMA plan [step **911**].

If the stream number **620** is non-zero, however, the Hub **110** determines the size and direction of the data transmission from the stream number **620** and waits for the time for sending the data in the TDMA plan (i.e., a data transfer **830**) [step **917**]. Later, when instructed to do so by the TDMA plan (i.e., after the PEA **120** identified by the MAC address **610** has had enough time to prepare), the Hub **110** transmits the contents of the data buffer **630** [step **918**]. The Hub **110** then prepares for the next token command in the TDMA plan [step **919**].

With regard to the PEA activity, the PEA **120** reaches a token command in the TDMA plan [step **921**] (FIG. **9**C). The PEA **120** then listens for the forward error-corrected token **640**, having a MAC address **610** and stream number **620**, transmitted by the Hub **110** [step **922**]. The PEA **120** decodes the MAC address from the forward error-corrected token [step **923**] and, if it is not the PEA's **120** MAC address, sleeps through the next data transfer **830** in the TDMA plan [step **924**]. Otherwise, the PEA **120** also decodes the stream number **620** from the token **640**.

All PEAs **120** listen for the Hub heartbeat that the Hub **110** broadcasts with a token containing the Hub's MAC address **610** and the heartbeat stream **770**. During attachment (described in more detail below), the PEA **120** may have two additional active MAC addresses **610**, the one it selected for attachment and the one the Hub **110** assigned to the PEA **120**. The streams are partitioned between these three classes of MAC addresses **610**, so the PEA **120** may occasionally find that the token **640** contains a MAC address **610** that the PEA **120** supports, but that the stream number **620** in the token **640** is not one that the PEA **120** supports for this MAC address **610**. In this case, the PEA **120** sleeps through the next data transfer **830** in the TDMA plan [step **924**].

Since the PEA **120** supports more than one MAC address **610**, the PEA **120** uses the MAC address **610** and the stream number **620** to identify a suitable empty data block [step **925**]. The PEA **120** writes the MAC address **610** and stream number **620** it received in the token **640** from the Hub **110** into the data block [step **926**]. The PEA **120** then determines the size and direction of the data transmission from the stream number **620** and waits for the transmission of the data buffer **630** contents from the Hub **110** during the next data transfer **830** in the TDMA plan [step **927**]. The PEA **120** stores the data in the data block [step **928**], and then prepares for the next token command in the TDMA plan [step **929**].

FIGS. **9**A-**9**C illustrate communication of a data block from the Hub **110** to a PEA **120**. When the PEA **120** transfers a data block to the Hub **110**, similar steps occur except that the Hub **110** first determines the next data block to receive (with its MAC address **610** and stream number **620**) and the transmission of the data buffer **630** contents occurs in the opposite direction. The Hub **110** needs to arrange in advance for receiving data from PEAs **120** by populating the MAC address **610** and stream number **620** into data blocks with empty data buffers **630**, because the Hub **110** generates the tokens for receiving data as well as for transmitting data.

FIGS. **10**A and **10**B are high-level diagrams of the states that the Hub **110** and PEA **120** LLT **440** (FIG. **4**) go through during a data transfer in an implementation consistent with the present invention. FIG. **10**A illustrates states of a Hub-to-PEA transfer and FIG. **10**B illustrates states of a PEA-to-Hub transfer.

During the Hub-to-PEA transfer (FIG. **10**A), the Hub **110** cycles through four states: fill, send even parity, fill, and send odd parity. The fill states indicate when the NI **430** (FIG. **4**) may fill a data snippet. The even and odd send states indicate when the Hub **110** sends even numbered and odd numbered snippets to the PEA **120**. The PEA **120** cycles through two states: want even and want odd. The two states indicate the PEA's **120** desire for data, with 'want even' indicating that the last snippet successfully received had odd parity. The PEA **120** communicates its current state to the Hub **110** via its status messages (i.e., the state changes serve as ACKs). The Hub **110** waits for a state change in the PEA **120** before it transitions to its next fill state.

During the PEA-to-Hub transfer (FIG. **10**B), the Hub **110** cycles through six states: wait/listen for PEA-ready-to-send-even status, read even, send ACK and listen for status, wait/listen for PEA-ready-to-send-odd status, read odd, and send ACK and listen for status. According to this transfer, the PEA **120** cannot transmit data until the Hub **110** requests data, which it will only do if it sees from the PEA's status that the PEA **120** has the next data block ready.

The four listen for status states schedule when the Hub **110** asks to receive a status message from the PEA **120**. The two 'send ACK and listen for status' states occur after successful receipt of a data block by the Hub **110**, and in these two states the Hub **110** schedules both the sending of Hub status to the PEA **120** and receipt of the PEA status. The PEA status informs the Hub **110** when the PEA **120** has successfully received the Hub **110** status and has transitioned to the next 'fill' state.

Once the PEA **120** has prepared its next snippet, it changes its status to 'have even' or 'have odd' as appropriate. When the Hub **110** detects that the PEA **120** has advanced to the fill state or to 'have even/odd,' it stops scheduling the sending of Hub status (ACK) to the PEA **120**. If the Hub **110** detects that the PEA **120** is in the 'fill' state, it transitions to the following 'listen for status' state. If the PEA **120** has already prepared a new snippet for transmission by the time the Hub **110** learns that its ACK was understood by the PEA **120**, the Hub **110** skips the 'listen for status' state and moves immediately to the next appropriate 'read even/odd' state. In this state, the Hub **110** receives the snippet from the PEA **120**.

The PEA **120** cycles through four states: fill, have even, fill, and have odd (i.e., the same four states the Hub **110** cycles through when sending snippets). The fill states indicate when the NI **430** (FIG. **4**) can fill a data snippet. During the fill states, the PEA **110** sets its status to 'have nothing to send.' The PEA **120** does not transition its status to 'have even' or 'have odd' until the next snippet is filled and ready to send to the Hub **110**. These two status states indicate the parity of the snippet that the PEA **120** is ready to send to the Hub **110**. When the Hub **110** receives a status of 'have even' or 'have odd' and the last snippet it successfully received had the opposite parity, it schedules the receipt of data, which it thereafter acknowledges with a change of status that it sends to the PEA **120**.

Exemplary Attachment Processing

The Hub **110** communicates with only attached PEAs **120** that have an assigned MAC address **610**. An unattached PEA can attach to the Hub **110** when the Hub **110** gives it an opportunity to do so. Periodically, the Hub **110** schedules attachment opportunities for unattached PEAs that wish to attach to the Hub **110**, using a small set of attach MAC (AMAC) addresses and a small set of streams dedicated to this purpose.

After selecting one of the designated AMAC addresses **610** at random to identify itself and preparing to send a small, possibly forward error-corrected, "attach-interest" message and a longer, possibly checksummed, "attach-request" message using this AMAC and the proper attach stream numbers **620**, the PEA **120** waits for the Hub **110** to successfully read the attach-interest and then the attach-request messages. Reading of a valid attach-interest message by the Hub **110** causes the Hub **110** believe that there is a PEA **120** ready to send the longer (and hence more likely corrupted) attach-request.

Once a valid attach-interest is received, the Hub **110** schedules frequent receipt of the attach-request until it determines the contents of the attach-request, either by receiving the block intact with a valid checksum or by reconstructing the

sent attach-request from two or more received instances of the sent attach-request. The Hub **110** then assigns a MAC address to the PEA **120**, sending the address to the PEA **120** using its AMAC address.

The Hub **110** confirms receipt of the MAC address by scheduling the reading of a small, possibly forward error-corrected, attach-confirmation from the PEA **120** at its new MAC address **610**. The Hub **110** follows this by sending a small, possibly forward error-corrected, confirmation to the PEA **120** at its MAC address so that the PEA **120** knows it is attached. The PEA **120** returns a final small, possibly forward error-corrected, confirmation acknowledgement to the Hub **110** so that the Hub **110**, which is in control of all scheduled activity, has full knowledge of the state of the PEA **120**. This MAC address remains assigned to that PEA **120** for the duration of the time that the PEA **120** is attached.

FIGS. **11** and **12** are flowcharts of Hub and PEA attachment processing, respectively, consistent with the present invention. When the Hub **110** establishes the network, its logic initializes the attachment process and, as long as the Hub **110** continues to function, periodically performs attachment processing. The Hub **110** periodically broadcasts heartbeats containing a Hub identifier (selecting a new heartbeat identifier value each time it reboots) and an indicator of the range of AMACs that can be selected from for the following attach opportunity [step **1110**] (FIG. **11**). The Hub **110** schedules an attach-interest via a token that schedules a small PEA-to-Hub transmission for each of the designated AMACs, so unattached PEAs may request attachment.

Each attaching PEA **120** selects a new AMAC at random from the indicated range when it hears the heartbeat. Because the Hub **110** may receive a garbled transmission whenever more than one PEA **120** transmits, the Hub **110** occasionally indicates a large AMAC range (especially after rebooting) so that at least one of a number of PEAs **120** may select a unique AMAC **610** and become attached. When no PEAs **120** have attached for some period of time, however, the Hub **110** may select a small range of AMACs **610** to reduce attachment overhead, assuming that PEAs **120** will arrive in its vicinity in at most small groups. The Hub **110** then listens for a valid attach-interest from an unattached PEA [step **1120**]. The attach-interest is a PEA-to-Hub message having the AMAC address **610** selected by the unattached PEA **120**.

Upon receiving a valid attach interest, the Hub **110** schedules a PEA-to-Hub attach-request token with the PEA's AMAC **610** and reads the PEA's attach-request [step **1130**]. Due to the low-power wireless environment of the PAN **100**, the attach-request transmission may take more than one attempt and hence may require scheduling the PEA-to-Hub attach-request token more than once. When the Hub **110** successfully receives the attach-request from the PEA, it assigns a MAC address to the PEA [step **1140**]. In some cases, the Hub **110** chooses the MAC address from the set of AMAC addresses.

The Hub **110** sends the new MAC address **610** in an attach-assignment message to the now-identified PEA **120**, still using the PEA's AMAC address **610** and a stream number **620** reserved for this purpose. The Hub **110** schedules and listens for an attach-confirmation response from the PEA **120** using the newly assigned MAC address **610** [step **1150**].

Upon receiving the confirmation from the PEA **120**, the Hub **110** sends its own confirmation, acknowledging that the PEA **120** has switched to its new MAC, to the PEA **120** and waits for a final acknowledgment from the PEA **120** [step **1160**]. The Hub **110** continues to send the confirmation until it receives the acknowledgment from the PEA **120** or until it times out. In each of the steps above, the Hub **110** counts the number of attempts it makes to send or receive, and aborts the attachment effort if a predefined maximum number of attempts is exceeded. Upon receiving the final acknowledgment, the Hub **110** stops sending its attach confirmation, informs its NI **430** (FIG. **4**) that the PEA **120** is attached, and begins exchanging both data and keep-alive messages (described below) with the PEA **120**.

When an unattached PEA **120** enters the network, its LLC **420** (FIG. **4**) instructs its LLT **440** to initialize attachment. Unlike the Hub **110**, the PEA **120** waits to be polled. The PEA **120** instructs its DCL **460** to activate and associate the heartbeat stream **770** (FIG. **7**B) with the Hub's MAC address and waits for the heartbeat broadcast from the Hub **110** [step **1210**] (FIG. **12**). The PEA **120** then selects a random AMAC address from the range indicated in the heartbeat to identify itself to the Hub **110** [step **1220**]. The PEA **120** instructs its DCL **460** to send an attach-interest and an attach-request data block to the Hub **110**, and activate and associate the streams with its AMAC address [step **1230**]. The PEA **120** tells its driver to activate and respond to the selected AMAC address for the attach-assignment stream.

The unattached PEA **120** then waits for an attach-assignment with an assigned MAC address from the Hub **110** [step **1240**]. Upon receiving the attach-assignment, the PEA **120** finds its Hub-assigned MAC address and tells its driver to use this MAC address to send an attach-confirmation to the Hub **110** to acknowledge receipt of its new MAC address [step **1250**], activate all attached-PEA streams for its new MAC address, and deactivate the streams associated with its AMAC address.

The PEA **120** waits for an attach confirmation from the Hub **110** using the new MAC address [step **1260**] and, upon receiving it, sends a final acknowledgment to the Hub **110** [step **1270**]. The PEA **120** then tells its NI **430** that it is attached.

The PEA **120**, if it hears another heartbeat from the Hub **110** before it completes attachment, discards any prior communication and begins its attachment processing over again with a new AMAC.

Exemplary Detachment and Reattachment Processing

The Hub **110** periodically informs all attached PEAs **120** that they are attached by sending them 'keep-alive' messages. The Hub **110** may send the messages at least as often as it transmits heartbeats. The Hub **110** may send individual small, possibly forward error-corrected, keep-alive messages to each attached PEA **120** when few PEAs **120** are attached, or may send larger, possibly forward error-corrected, keep-alive messages to groups of PEAs **120**.

Whenever the Hub **110** schedules tokens for PEA-to-Hub communications, it sets a counter to zero. The counter resets to zero each time the Hub **110** successfully receives a block (either uncorrupted or reconstructed) from the PEA **120**, and increments for unreadable blocks. If the counter exceeds a predefined threshold, the Hub **110** automatically detaches the PEA **120** without any negotiation with the PEA **120**. After this happens, the Hub **110** no longer schedules data or status transfers to or from the PEA **120**, and no longer sends it any keep-alive messages.

FIG. **13** is a flowchart of PEA detachment and reattachment processing consistent with the present invention. Each attached PEA **120** listens for Hub heartbeat and keep-alive messages [step **1310**]. When the PEA **120** first attaches, and after receiving each keep-alive message, it resets its heartbeat counter to zero [step **1320**]. Each time the PEA **120** hears a

heartbeat, it increments the heartbeat counter [step **1330**]. If the heartbeat counter exceeds a predefined threshold, the PEA **120** automatically assumes that the Hub **110** has detached it from the network **100** [step **1340**]. After this happens, the PEA **120** attempts to reattach to the Hub **110** [step **1350**], using attachment processing similar to that described with respect to FIGS. **11** and **12**.

If the Hub **110** had not actually detached the PEA **120**, then the attempt to reattach causes the Hub **110** to detach the PEA **120** so that the attempt to reattach can succeed. When the PEA **120** is out of range of the Hub **110**, it may not hear from the Hub **110** and, therefore, does not change state or increment its heartbeat counter. The PEA **120** has no way to determine whether the Hub **110** has detached it or how long the Hub **110** might wait before detaching it. When the PEA **120** comes back into range of the Hub **110** and hears the Hub heartbeat (and keep-alive if sent), the PEA **120** then determines whether it is attached and attempts to reattach if necessary.

CONCLUSION

Systems and methods consistent with the present invention provide a wireless personal area network that permit a host device to communicate with a varying number of peripheral devices with minimal power and minimal interference from neighboring networks by using a customized TDMA protocol. The host device uses tokens to facilitate the transmission of data blocks through the network.

The foregoing description of exemplary embodiments of the present invention provides illustration and description, but is not intended to be exhaustive or to limit the invention to the precise form disclosed. Modifications and variations are possible in light of the above teachings or may be acquired from practice of the invention. The scope of the invention is defined by the claims and their equivalents.

What is claimed is:

1. A method of communicating between a first peripheral device and a hub device in a personal area network, comprising:

sending by the hub device, a signal to indicate availability of the hub device for peripheral attachment,

in response to the signal sent by the hub device, sending by the first peripheral device, a signal to indicate availability of the first peripheral device for communication with the hub device,

sending, by the hub device to the first peripheral device, a signal including a first peripheral device identifier,

subsequent to sending the signal including a first peripheral device identifier from the hub device, sending by the first peripheral device to the hub device a first peripheral response,

subsequent to the receiving of the first peripheral response by the hub device, sending by the hub device to the first peripheral device a hub response, and

subsequent to the receiving of the hub response by the first peripheral device, sending by the first peripheral device to the hub device a second peripheral response including the first peripheral device identifier.

2. The method according to claim **1**, wherein the first peripheral device identifier is based at least in part on a MAC address of the first peripheral device.

3. The method according to claim **2**, wherein the MAC address for the first peripheral device includes an AMAC address for the first peripheral device.

4. The method according to claim **2**, wherein the MAC address for the first peripheral device is different from an AMAC address for the first peripheral device.

5. The method according to claim **1**, wherein the hub device controls the allocation of communications channels among a plurality of peripheral devices with which the hub device is communicating.

6. The method according to claim **1** comprising communicating, by the hub device, with at least one additional peripheral device having a peripheral device identifier different from the first peripheral device identifier.

7. The method according to claim **1** comprising broadcasting a message from the hub device to a plurality of peripheral devices with which the hub device is attached, the message including a broadcast identifier.

8. The method according to claim **1**, wherein the signal broadcast from the hub device includes a range of peripheral device identifiers, one of which being the first peripheral device identifier.

9. The method according to claim **8** comprising receiving at the hub device, identifiers within the range of the identifier of the peripheral device for a plurality of other peripheral devices indicating their availability for communication with the hub device in response to the signal sent by the hub device.

10. The method according to claim **1** comprising assigning, by the hub device to the first peripheral device, one or more additional identifiers to the first peripheral device, wherein the one or more additional identifiers is used to further identify communications between the hub device and the first peripheral device.

11. The method according to claim **10**, wherein the one or more additional identifiers include a stream number for identifying a particular communication channel between the peripheral device and the hub device.

12. The method of claim **10**, wherein the one or more additional identifiers include a token that includes a stream number for identifying a particular communication channel between the first peripheral device and the hub device, and the first peripheral device identifier.

13. The method of claim **1**, wherein the identifier is associated with a network address.

14. A hub device for use within a personal area network, comprising:

circuitry, and

a transceiver in communication with the circuitry, the hub device configured to cause the transceiver to

i) send a message to indicate the availability of the hub device for peripheral device attachment,

ii) receive, from a first peripheral device, a message indicating the availability of the first peripheral device for communication with the hub device,

iii) send, to the first peripheral device, a signal including a first peripheral device identifier,

iv) receive, from the first peripheral device, a response,

v) send a hub response to the first peripheral device, and

vi) receive, from the first peripheral device, a second peripheral response including the first peripheral device identifier.

15. The device according to claim **14**, wherein the first peripheral device identifier is based at least in part on a MAC address for the first peripheral device.

16. The device according to claim **15**, wherein the MAC address for the first peripheral device includes an AMAC address for the first peripheral device.

17. The device according to claim **15**, wherein the MAC address for the first peripheral device is different from an AMAC address for the first peripheral device.

18. The device according to claim **14**, wherein the circuitry is configured to control the allocation of communication

channels among a plurality of peripheral devices with which the hub device is communicating.

19. The device according to claim **14**, wherein the hub device is configured to cause the transceiver to communicate with at least one additional peripheral device having a peripheral device identifier different from the first peripheral device identifier.

20. The device according to claim **14**, wherein the transceiver is configured to broadcast a signal from hub device to a plurality of peripheral devices with which the hub device is attached, the signal including a broadcast identifier.

21. The device according to claim **14**, wherein the signal sent from the hub device includes a range of peripheral device identifiers, one of which being the first peripheral device identifier.

22. The device according to claim **21**, wherein the transceiver is configured to receive identifiers within the range of the peripheral device identifiers for a plurality of other peripheral devices indicating their availability for communication with the hub device in response to the signal sent by the hub device.

23. The device according to claim **14**, wherein the transceiver is configured to send one or more additional identifiers to the first peripheral device, wherein the one or more identifiers are used to further identify communications between the hub device and the first peripheral device.

24. The device according to claim **23**, wherein the one or more additional identifiers include a stream number for identifying a particular communication channel between the first peripheral device and the hub device.

25. The device according to claim **23**, wherein the one or more additional identifiers include a token that includes a stream number for identifying a particular communication channel between the first peripheral device and the hub device, and the first peripheral device identifier.

26. The device according to claim **14**, wherein the identifier is associated with a network address.

27. A peripheral device for use within a personal area network, comprising:

circuitry, and

a transceiver in communication with the circuitry, the peripheral device configured to cause the transceiver to

i) receive a sent message from a hub device to indicate the availability of the hub device for peripheral device attachment,

ii) send, to the hub device, a message indicating the availability of the peripheral device for communication with the hub device,

iii) receive, from the hub device, a signal including a peripheral device identifier,

iv) send a response to the hub device,

v) receive, from the hub device, a hub response, and

vi) send, to the hub device, a second peripheral response including the peripheral device identifier.

28. The device according to claim **27**, wherein the peripheral device identifier is based at least in part on a MAC address for the peripheral device.

29. The device according to claim **28**, wherein the MAC address for the peripheral device includes an AMAC address for the peripheral device.

30. The device according to claim **28**, wherein the MAC address for the peripheral device is different from an AMAC address for the peripheral device.

31. The device according to claim **27**, wherein the circuitry is configured to manage network timing with the hub device to enable the allocation of available bandwidth with other peripheral devices which the hub device is currently communicating.

32. The device according to claim **27**, wherein the transceiver is configured to receive a signal broadcast from the hub device including a broadcast identifier.

33. The device according to claim **27**, wherein the transceiver is configured to receive a broadcast signal from the hub device including a range of peripheral device identifiers, one of which being the peripheral device identifier.

34. The device according to claim **27**, wherein the transceiver is configured to receive, from the hub device, one or more additional identifiers, wherein the one or more identifiers are used to further identify communications between the hub device and the peripheral device.

35. The device according to claim **34**, wherein the one or more additional identifiers include a stream number for identifying a particular communication channel between the peripheral device and the hub device.

36. The device according to claim **34**, wherein the one or more identifiers include a token that includes a stream number for identifying a particular communication channel between the peripheral device and the hub device, and the peripheral device identifier.

37. The device according to claim **27**, wherein the identifier is associated with a network address.

38. The hub device according to claim **14**, wherein the hub device is operable such that different channels are utilized for different functions.

39. The hub device according to claim **14**, wherein the hub device includes a transceiver and digital control logic integrated on a single integrated circuit.

40. The hub device according to claim **14**, wherein the hub device includes a host on a single integrated circuit.

41. The hub device according to claim **14**, wherein the hub device includes a transceiver integrated on a single integrated circuit.

42. The hub device according to claim **14**, wherein the hub device includes digital control logic integrated on a single integrated circuit.

43. The hub device according to claim **14**, wherein the hub device is configured such that a plurality of MAC addresses is capable of being used for identification in association with the first peripheral device.

44. The hub device according to claim **43**, wherein the hub response to the first peripheral device includes the first peripheral device identifier.

45. The hub device according to claim **43**, wherein the first peripheral device includes a plurality of virtual entities.

46. The hub device according to claim **45**, wherein each of the plurality of virtual entities is capable of being identified utilizing an associated one of the plurality of MAC addresses.

47. The hub device according to claim **43**, wherein the plurality of MAC addresses exist simultaneously.

48. The hub device according to claim **43**, wherein the hub device is operable such that the plurality of MAC addresses is used by a link layer embodied on a computer readable medium.

49. The hub device according to claim **48**, wherein the link layer resides between a physical layer and a network layer embodied on the computer readable medium.

50. The hub device according to claim **48**, wherein the link layer is responsible for assignment of the plurality of MAC addresses.

51. The hub device according to claim **43**, wherein the plurality of MAC addresses includes at least three MAC addresses.

52. The hub device according to claim 43, wherein the hub device is configured to cause the transceiver to follow a protocol that involves a plurality of data blocks and a plurality of status blocks that include a channel identifier in connection with each of the data blocks and the status blocks, wherein the data blocks are capable of being used for retransmission of data.

53. The hub device according to claim 43, wherein the hub device is configured to cause the transceiver to follow a protocol that involves a plurality of data blocks and a plurality of status blocks that each include a channel identifier.

54. The hub device according to claim 53, wherein the channel identifier includes a stream number.

55. The hub device according to claim 53, wherein the status blocks are utilized for controlling retransmission.

56. The hub device according to claim 53, wherein a first channel identifier associated with at least one of the status blocks is different than a second channel identifier associated with at least one of the data blocks.

57. The hub device according to claim 53, wherein at least one of the data blocks includes data to be retransmitted and at least one of the status blocks is adapted for controlling transmission of the at least one data block.

58. The hub device according to claim 43, wherein the message to indicate the availability of the hub device for peripheral device attachment is sent via a broadcast.

59. The hub device according to claim 43, wherein the peripheral device attachment and peripheral device detachment is automatic.

60. The hub device according to claim 43, wherein the hub device is configured such that the plurality of MAC addresses is used to identify the first peripheral device.

61. The hub device according to claim 43, wherein the plurality of MAC addresses is associated with the first peripheral device.

62. The hub device according to claim 43, wherein the hub device is operable such that the plurality of MAC addresses is capable of being used to identify peripheral entities associated with the first peripheral device, the peripheral device attachment is automatic, and at least three MAC addresses are capable of existing simultaneously in association with the first peripheral device, which includes a single physical device.

63. The hub device according to claim 43, wherein the plurality of MAC addresses is each associated with a separate class of MAC addresses.

64. The hub device according to claim 43, wherein the hub device is configured to control allocation of communication channels among a plurality of peripheral devices with which the hub device is communicating.

65. The hub device according to claim 43, wherein the hub device is configured to cause the transceiver to communicate with at least one additional peripheral device having a peripheral device identifier different from the first peripheral device identifier.

66. The hub device according to claim 43, wherein the hub device is configured to cause the transceiver to send one or more additional identifiers to the first peripheral device, wherein the one or more identifiers is used to further identify communications between the hub device and the first peripheral device.

67. The hub device according to claim 66, wherein the one or more additional identifiers includes a stream number for identifying a particular communication channel between the first peripheral device and the hub device.

68. The hub device according to claim 66, wherein the one or more additional identifiers is associated with a token that includes a stream number for identifying a particular communication channel between the first peripheral device and the hub device.

69. The hub device according to claim 43, wherein the message to indicate the availability of the hub device for peripheral device attachment includes a heartbeat signal.

70. The hub device according to claim 43, wherein the message to indicate the availability of the hub device for peripheral device attachment is an initial message.

71. The hub device according to claim 43, wherein the hub device is operable such that an attachment process is initialized with the message to indicate the availability of the hub device for peripheral device attachment.

72. The hub device according to claim 43, wherein the hub device is operable such that the message to indicate the availability of the hub device for peripheral device attachment is sent repeatedly.

73. The hub device according to claim 43, wherein the hub device is configured to cause the transceiver to follow a protocol that involves a plurality of data blocks and a plurality of status blocks that each include a channel identifier, in association with transmission of data multiple times.

74. The hub device according to claim 73, wherein the hub device is operable such that an attachment process is initialized with the message to indicate the availability of the hub device for peripheral device attachment.

75. The hub device according to claim 43, wherein the message indicating the availability of the first peripheral device includes an attachment peripheral device identifier.

76. The hub device according to claim 75, wherein the attachment peripheral device identifier is initially provided by the first peripheral device after the message to indicate the availability of the hub device for peripheral device attachment is sent.

77. The hub device according to claim 75, wherein the attachment peripheral device identifier is received from the first peripheral device in response to the message to indicate the availability of the hub device for peripheral device attachment.

78. The hub device according to claim 43, wherein the message indicating the availability of the first peripheral device includes a temporary peripheral device identifier, for use during an attachment process.

79. The hub device according to claim 43, wherein the hub device is operable such that: one of the MAC addresses is used for identification in association with a first entity of the first peripheral device and another one of the MAC addresses is used for identification in association with a second entity of the first peripheral device; the first entity includes a first controller and the second entity includes a second controller; at least three of the MAC addresses are capable of existing simultaneously in association with the first peripheral device which includes a single physical device; the transceiver is caused to follow a protocol that involves a plurality of data blocks and a plurality of status blocks that each include a channel identifier, in association with transmission of data multiple times; a first one of the MAC addresses is capable of being utilized for attachment purposes and a second one of the MAC addresses is capable of being utilized for data transfer; the first one of the MAC addresses is capable of being initially used for the attachment purposes in association with the first peripheral device without use of the second one of the MAC addresses, after which the second one of the MAC addresses is capable of being utilized; and the first one of the MAC addresses has a first one or more channels associated therewith with a capability of transferring a first amount of data and the second one of the MAC addresses has a second one or

more channels associated therewith with a capability of transferring a second amount of data different than the first amount of data.

80. The hub device according to claim **79**, wherein the hub device is operable such that the plurality of MAC addresses is used by a link layer embodied on a computer readable medium that resides between a physical layer and a network layer embodied on the computer readable medium, the link layer being responsible for assignment of the plurality of MAC addresses.

81. The hub device according to claim **79**, wherein the hub device is operable such that an attachment process is initialized with the message to indicate the availability of the hub device for peripheral device attachment; the message to indicate the availability of the hub device for peripheral device attachment is sent repeatedly; i)-vi) are communications associated with the attachment process; the transceiver is caused to communicate between the hub device and the first peripheral device, utilizing one or more additional identifiers; and a memory is included with a control structure embodied thereon that performs network bandwidth control.

82. The hub device according to claim **43**, wherein the first peripheral device identifier includes a newly-selected address.

83. The hub device according to claim **43**, wherein the message indicating the availability of the first peripheral device includes an attachment peripheral device identifier that is selected by the first peripheral device.

84. The hub device according to claim **43**, wherein the hub device is configured for reattachment.

85. The hub device according to claim **84**, wherein the reattachment involves an attach request using a previously-assigned address.

86. The hub device according to claim **84**, wherein the reattachment involves an attach request using a newly-selected address.

87. The hub device according to claim **43**, wherein at least i)-iv) are communications associated with an attachment process.

88. The hub device according to claim **43**, wherein i)-vi) are communications associated with an attachment process.

89. The hub device according to claim **43**, wherein iv) includes a confirmation message.

90. The hub device according to claim **43**, wherein v) includes a confirmation message.

91. The hub device according to claim **43**, wherein vi) includes an acknowledgement message.

92. The hub device according to claim **43**, wherein i)-vi) are the only communications associated with an attachment process.

93. The hub device according to claim **43**, wherein no other communications occur between i)-ii), no other communications occur between ii)-iii), no other communications occur between iii)-iv), no other communications occur between iv)-v), and no other communications occur between v)-vi).

94. The hub device according to claim **43**, wherein the hub device is configured to send keep-alive messages.

95. The hub device according to claim **43**, wherein the hub device is configured to cause the transceiver to communicate between the hub device and the first peripheral device, utilizing one or more additional identifiers.

96. The hub device according to claim **95**, wherein the one or more additional identifiers includes a stream identifier.

97. The hub device according to claim **95**, wherein the one or more additional identifiers indicates a direction of a data transfer.

98. The hub device according to claim **95**, wherein the one or more additional identifiers indicates a size of a data transfer.

99. The hub device according to claim **95**, wherein the hub device is operable such that the one or more additional identifiers is sent from the hub device to the first peripheral device.

100. The hub device according to claim **95**, wherein the hub device is operable such that the one or more additional identifiers is used to further identify communications between the hub device and the first peripheral device.

101. The hub device according to claim **95**, wherein the one or more additional identifiers includes a stream number for identifying a communication channel between the first peripheral device and the hub device.

102. The hub device according to claim **101**, wherein the communication channel is uni-directional.

103. The hub device according to claim **95**, wherein the one or more additional identifiers are included in a token.

104. The hub device according to claim **103**, wherein the token includes a stream number.

105. The hub device according to claim **104**, wherein the stream number is for identifying a particular communication channel between the first peripheral device and the hub device.

106. The hub device according to claim **104**, wherein the stream number is for identifying a particular communication channel between the first peripheral device and the hub device, and the token further includes an address for the first peripheral device.

107. The hub device according to claim **43**, wherein the hub device is configured to cause the transceiver to communicate via a communications protocol shared by the hub device and the first peripheral device to synchronize timing of the communication.

108. The hub device according to claim **107**, wherein the communications protocol includes a plurality of frames.

109. The hub device according to claim **108**, wherein each of the frames includes a signal that marks a start of the frame.

110. The hub device according to claim **108**, wherein each of the frames is associated with at least one data transfer opportunity that permits the hub device to communicate a data block with the first peripheral device.

111. The hub device according to claim **43**, wherein the hub device includes a memory including a control structure embodied thereon that performs network bandwidth control.

112. The hub device according to claim **43**, wherein the hub device includes a memory including a control structure embodied thereon that performs token planning.

113. The hub device according to claim **43**, wherein the hub device includes a memory including a network interface structure embodied thereon that determines whether or when to schedule a data transfer, and a link layer transport structure embodied thereon that provides a reliable data transfer for a network interface.

114. The hub device according to claim **43**, wherein the hub device includes a memory including a link layer transport structure embodied thereon that provides a reliable data transfer for a network interface.

115. The hub device according to claim **43**, wherein the hub device includes a memory including a link layer control structure embodied thereon that performs token planning or bandwidth control.

116. The hub device according to claim **43**, wherein the hub device includes a memory including a structure embodied thereon that provides a reliable data transfer for a network interface.

117. The hub device according to claim 43, wherein at least one of the hub device and the first peripheral device is further configured to transfer the same data in multiple forms.

118. The hub device according to claim 117, wherein a stream on which the data is communicated indicates a form of transfer.

119. The hub device according to claim 117, wherein at least one of the hub device and the first peripheral device is further configured to combine the multiple forms of the same data to reconstruct the data.

120. The hub device according to claim 117, wherein the multiple forms include an original form and at least one of a complemented form and a reverse order form.

121. The hub device according to claim 117, wherein the multiple forms include at least one of a complemented form and a reverse order form.

122. The hub device according to claim 43, wherein the hub device is further configured to schedule transmission of a status block from the first peripheral device.

123. The hub device according to claim 122, wherein the hub device is further configured to schedule transmission of data from the first peripheral device when the status block from the first peripheral device indicates that the first peripheral device has data ready for transmission to the hub device.

124. The hub device according to claim 43, wherein the hub device is operable such that the plurality of MAC addresses is capable of being used to identify virtual peripheral entities associated with the first peripheral device, the peripheral device attachment is automatic, at least three MAC addresses are capable of existing simultaneously, a first one of the MAC addresses is utilized for attachment purposes, and a second one of the MAC addresses is utilized for data transfer.

125. The hub device according to claim 43, wherein the hub device is operable such that a first one of the MAC addresses is utilized for attachment purposes.

126. The hub device according to claim 125, wherein the hub device is operable such that a second one of the MAC addresses is utilized for data transfer.

127. The hub device according to claim 125, wherein the hub device is operable such that the first one of the MAC addresses is also used for data transfer.

128. The hub device according to claim 125, wherein the hub device is operable such that a second one of the MAC addresses is utilized for non-attachment purposes.

129. The hub device according to claim 43, wherein the hub device is operable such that a first one of the MAC addresses has a first plurality of channels associated therewith and a second one of the MAC addresses has a second plurality of channels associated therewith.

130. The hub device according to claim 129, wherein the first plurality of channels include channels supported by the first MAC address.

131. The hub device according to claim 129, wherein the first plurality of channels include active channels supported by the first MAC address.

132. The hub device according to claim 129, wherein the hub device is operable such that different channels are utilized for different functions.

133. The hub device according to claim 43, wherein the hub device includes a transceiver and digital control logic integrated on a single integrated circuit.

134. The hub device according to claim 43, wherein the hub device includes a host, a transceiver, and digital control logic integrated on a single integrated circuit.

135. The hub device according to claim 43, and further comprising: a software architecture embodied in memory including a link layer driver layer, a link layer transport layer, a network interface layer, and a link layer control layer.

136. The hub device according to claim 43, and further comprising: a software architecture embodied in memory including i) a link layer driver layer, ii) a link layer transport layer, and iii) a network interface layer, where i) resides below ii), and ii) resides below iii).

137. The hub device according to claim 43, wherein the hub device is operable such that a first one of the MAC addresses has a first plurality of channels associated therewith with a capability of transferring a first amount of data and a second one of the MAC addresses has a second plurality of channels associated therewith with a capability of transferring a second amount of data less than the first amount of data.

138. The hub device according to claim 137, wherein the first amount of data is provided utilizing a first data block size, and the second amount of data is provided utilizing a second data block size.

139. The hub device according to claim 43, wherein the hub device is operable such that a first one of the MAC addresses has a plurality of channels associated therewith with a capability of transferring an amount of data that has an associated maximum size.

140. The hub device according to claim 43, wherein the hub device is operable such that a plurality of streams are partitioned between the MAC addresses.

141. The hub device according to claim 43, wherein the circuitry includes a processor.

142. The hub device according to claim 43, wherein the circuitry includes a microcontroller.

143. The hub device according to claim 43, wherein the first peripheral identifier is one of the MAC addresses.

144. The hub device according to claim 43, wherein the hub device is operable such that i) occurs before ii), ii) occurs before iii), iv) occurs before v), and vi) occurs before v).

145. The hub device according to claim 43, wherein the hub device is operable such that only a first one of the MAC addresses is initially used for identification in association with the first peripheral device, after which a second one of the MAC addresses is utilized.

146. The hub device according to claim 43, wherein the hub device is operable such that only a first one of the MAC addresses is initially used for identification in association with the first peripheral device, after which a second one of the MAC addresses is utilized simultaneously with the first MAC address.

147. The hub device according to claim 43, wherein the hub device is operable such that a first one of the MAC addresses is used for identification in association with a first entity of the first peripheral device, and a second one of the MAC addresses is used for identification in association with a second entity of the first peripheral device.

148. The hub device according to claim 147, wherein the first entity includes a first controller, and the second entity includes a second controller.

149. The hub device according to claim 43, wherein the hub device is operable such that a first one of the MAC addresses has a first plurality of channels associated therewith with a first capability and a second one of the MAC addresses has a second plurality of channels associated therewith with a second capability different from the first capability.

150. The hub device according to claim 43, wherein the hub device is operable such that a first one of the MAC addresses has a first plurality of channels associated therewith with a first communication purpose and a second one of the MAC addresses has a second plurality of channels associated

therewith with a second communication purpose different from the first communication purpose.

151. The hub device according to claim **43**, wherein the hub device is operable such that data is sent via a first channel, and the same data is also sent via a second channel.

152. The hub device according to claim **151**, wherein the hub device is operable such that the data is sent via the first channel using a first format, and the data is sent via the second channel using a second format.

153. The hub device according to claim **43**, wherein the hub device is operable such that the plurality of MAC addresses is capable of being used to identify virtual peripheral entities associated with the first peripheral device, where the first peripheral device includes a single physical device.

154. The hub device according to claim **153**, wherein the virtual peripheral entities include virtual devices.

155. The hub device according to claim **43**, wherein the hub device is operable such that responses are received in connection with each of the plurality of MAC addresses.

156. The hub device according to claim **43**, wherein the hub device is operable such that at least one active communication stream is associated with each of the plurality of MAC addresses.

157. The hub device according to claim **43**, wherein the first peripheral device includes a plurality of virtual peripheral devices.

158. The hub device according to claim **43**, wherein the peripheral device attachment is automatic.

159. The hub device according to claim **43**, wherein the hub device includes a computer readable medium with computer code embodied thereon including a transport layer.

160. The hub device according to claim **14**, wherein the sent message is a broadcasted message.

161. The hub device according to claim **160**, wherein the response in iv) includes the first peripheral device identifier.

162. The hub device according to claim **161**, wherein the broadcasted message includes a heartbeat signal.

163. The hub device according to claim **161**, wherein the broadcasted message is an initial message.

164. The hub device according to claim **161**, wherein the hub device is operable such that an attachment process is initialized with the broadcasted message.

165. The hub device according to claim **161**, wherein the hub device is operable such that the broadcasted message is broadcasted periodically.

166. The hub device according to claim **161**, wherein the broadcasted message includes a hub device identifier.

167. The hub device according to claim **166**, wherein the hub device identifier includes a MAC address.

168. The hub device according to claim **166**, wherein the hub device is operable such that an attachment process is initialized with the broadcasted message.

169. The hub device according to claim **161**, wherein the message indicating the availability of the first peripheral device includes an attachment peripheral device identifier.

170. The hub device according to claim **169**, wherein the hub device is operable such that the attachment peripheral device identifier is initially received from the first peripheral device after the broadcasted message is broadcasted.

171. The hub device according to claim **169**, wherein the hub device is operable such that the attachment peripheral device identifier is received from the first peripheral device in response to the broadcasted message.

172. The hub device according to claim **161**, wherein the message indicating the availability of the first peripheral device includes a temporary peripheral device identifier, for use during an attachment process.

173. The hub device according to claim **161**, wherein the message indicating the availability of the first peripheral device includes an attachment peripheral device identifier that is, at least in part, randomly selected.

174. The hub device according to claim **161**, wherein the message indicating the availability of the first peripheral device includes an attachment peripheral device identifier that is selected from a range of identifiers.

175. The hub device according to claim **161**, wherein the message indicating the availability of the first peripheral device includes an attachment peripheral device identifier that is selected by the first peripheral device.

176. The hub device according to claim **161**, wherein the first peripheral device identifier includes a newly-selected address.

177. The hub device according to claim **161**, wherein the first peripheral device identifier includes a previously-assigned address.

178. The hub device according to claim **161**, wherein the hub device is configured to cause the transceiver to perform a reattachment process.

179. The hub device according to claim **178**, wherein the reattachment process involves an attach request using a previously-assigned address.

180. The hub device according to claim **178**, wherein the reattachment process involves an attach request using a newly-selected address.

181. The hub device according to claim **161**, wherein at least i)-iii) are communications associated with an attachment process.

182. The hub device according to claim **161**, wherein at least i)-iv) are communications associated with an attachment process.

183. The hub device according to claim **161**, wherein iv) includes a confirmation message.

184. The hub device according to claim **161**, wherein v) includes a confirmation message.

185. The hub device according to claim **161**, wherein vi) includes an acknowledgement message.

186. The hub device according to claim **161**, wherein no other communications occur between i) and ii).

187. The hub device according to claim **161**, wherein no other communications occur between ii) and iii).

188. The hub device according to claim **161**, wherein the hub device is configured to send keep-alive messages.

189. The hub device according to claim **161**, wherein the hub device is configured to cause the transceiver to communicate with the first peripheral device, utilizing one or more additional identifiers.

190. The hub device according to claim **189**, wherein the one or more additional identifiers includes a stream identifier.

191. The hub device according to claim **189**, wherein the one or more additional identifiers indicates a direction of a data transfer.

192. The hub device according to claim **189**, wherein the one or more additional identifiers indicates a size of a data transfer.

193. The hub device according to claim **189**, wherein the hub device is configured such that the one or more additional identifiers is sent from the hub device to the first peripheral device.

194. The hub device according to claim **189**, wherein the hub device is configured such that the one or more additional identifiers is used to further identify communications between the hub device and the first peripheral device.

195. The hub device according to claim **189**, wherein the one or more additional identifiers includes a stream number

for identifying a communication channel between the first peripheral device and the hub device.

196. The hub device according to claim **195**, wherein the communication channel is uni-directional.

197. The hub device according to claim **189**, wherein the one or more additional identifiers is associated with a token.

198. The hub device according to claim **197**, wherein the token includes a stream number.

199. The hub device according to claim **198**, wherein the stream number is for identifying a particular communication channel between the first peripheral device and the hub device.

200. The hub device according to claim **198**, wherein the stream number is for identifying a particular communication channel between the first peripheral device and the hub device, and the token further includes an address for the first peripheral device.

201. The hub device according to claim **161**, wherein the hub device is configured to cause the transceiver to communicate via a communications protocol shared by the hub device and the first peripheral device to synchronize timing of the communication.

202. The hub device according to claim **201**, wherein the communications protocol includes a plurality of frames.

203. The hub device according to claim **202**, wherein each of the frames includes a signal that marks a start of the frame.

204. The hub device according to claim **202**, wherein each of the frames includes at least one token transmission that identifies at least one data transfer opportunity that permits the hub device to communicate a data block with the first peripheral device.

205. The hub device according to claim **161**, wherein the hub device includes a memory including a control structure embodied thereon that performs network bandwidth control.

206. The hub device according to claim **161**, wherein the hub device includes a memory including a control structure embodied thereon that performs token planning.

207. The hub device according to claim **161**, wherein the hub device includes a memory including a network interface structure embodied thereon that determines whether or when to schedule a data transfer, and a link layer transport structure embodied thereon that provides a reliable data transfer for a network interface.

208. The hub device according to claim **161**, wherein the hub device includes a memory including a link layer transport structure embodied thereon that provides a reliable data transfer for a network interface.

209. The hub device according to claim **161**, wherein the first peripheral device includes a memory including a link layer control structure embodied thereon that performs token planning.

210. The hub device according to claim **161**, wherein the first peripheral device includes a memory including a link layer transport structure embodied thereon that provides a reliable data transfer for a network interface.

211. The hub device according to claim **161**, wherein at least one of the hub device and the first peripheral device is further configured to transfer the same data in multiple forms.

212. The hub device according to claim **211**, wherein a stream on which the data is communicated indicates a form of transfer.

213. The hub device according to claim **211**, wherein at least one of the hub device and the first peripheral device is further configured to combine the multiple forms of the same data to reconstruct the data.

214. The hub device according to claim **211**, wherein the multiple forms include an original form and at least one of a complemented form and a reverse order form.

215. The hub device according to claim **211**, wherein the multiple forms include at least one of a complemented form and a reverse order form.

216. The hub device according to claim **161**, wherein the hub device is further configured to schedule transmission of a status block from the first peripheral device.

217. The hub device according to claim **216**, wherein the hub device is further configured to schedule transmission of data from the first peripheral device when the status block from the first peripheral device indicates that the first peripheral device has data ready for transmission to the hub device.

218. The method according to claim **1**, wherein the communication between the first peripheral device and the hub device is such that a plurality of MAC addresses is capable of being used for identification purposes in connection with the first peripheral device.

219. The peripheral device according to claim **27**, wherein the peripheral device is operable such that different channels are utilized for different functions.

220. The peripheral device according to claim **27**, wherein the peripheral device includes a transceiver and digital control logic integrated on a single integrated circuit.

221. The peripheral device according to claim **27**, wherein the peripheral device is configured such that a plurality of MAC addresses is capable of being used for identification in association therewith.

222. The peripheral device according to claim **221**, wherein the hub response includes the peripheral device identifier.

223. The peripheral device according to claim **221**, wherein the peripheral device includes a plurality of virtual entities.

224. The peripheral device according to claim **223**, wherein the peripheral device is operable such that each of the plurality of virtual entities is capable of being identified utilizing an associated one of the plurality of MAC addresses.

225. The peripheral device according to claim **221**, wherein the plurality of MAC addresses exist simultaneously.

226. The peripheral device according to claim **221**, wherein the peripheral device is operable such that the plurality of MAC addresses is used by a link layer embodied on a computer readable medium.

227. The peripheral device according to claim **226**, wherein the link layer resides between a physical layer and a network layer embodied on the computer readable medium.

228. The peripheral device according to claim **226**, wherein the link layer is responsible for assignment of the plurality of MAC addresses.

229. The peripheral device according to claim **221**, wherein the plurality of MAC addresses includes at least three MAC addresses.

230. The peripheral device according to claim **221**, wherein the peripheral device is configured to cause the transceiver to follow a protocol that involves a plurality of data blocks and a plurality of status blocks that each include a channel identifier, in association with retransmission of data such that the data is transmitted multiple times.

231. The peripheral device according to claim **221**, wherein the peripheral device is configured to cause the transceiver to follow a protocol that involves a plurality of data blocks and a plurality of status blocks that each include a channel identifier.

232. The peripheral device according to claim **231**, wherein the channel identifier includes a stream number.

233. The peripheral device according to claim 231, wherein the status blocks are utilized for controlling retransmission.

234. The peripheral device according to claim 231, wherein a first channel identifier associated with at least one of the status blocks is different than a second channel identifier associated with at least one of the data blocks.

235. The peripheral device according to claim 231, wherein at least one of the data blocks includes data to be retransmitted and at least one of the status blocks is adapted for controlling transmission of the at least one data block.

236. The peripheral device according to claim 221, wherein the message to indicate the availability of the hub device for peripheral device attachment is sent via a broadcast.

237. The peripheral device according to claim 221, wherein the peripheral device attachment and peripheral device detachment is automatic.

238. The peripheral device according to claim 221, wherein the peripheral device is configured such that the plurality of MAC addresses is used to identify the peripheral device.

239. The peripheral device according to claim 221, wherein the plurality of MAC addresses is associated with the peripheral device.

240. The peripheral device according to claim 221, wherein the peripheral device is operable such that the plurality of MAC addresses is capable of being used to identify virtual peripheral entities associated with the peripheral device, the peripheral device attachment is automatic, and at least three of the MAC addresses are capable of existing simultaneously in association with the peripheral device.

241. The peripheral device according to claim 221, wherein the circuitry is configured to manage network timing with the hub device to enable the allocation of available bandwidth with other peripheral devices with which the hub device is currently communicating.

242. The peripheral device according to claim 221, wherein the peripheral device is configured to cause the transceiver to send, to the hub device, one or more additional identifiers, wherein the one or more identifiers is used to further identify communications between the hub device and the peripheral device.

243. The peripheral device according to claim 242, wherein the one or more additional identifiers includes a stream number for identifying a particular communication channel between the peripheral device and the hub device.

244. The peripheral device according to claim 242, wherein the one or more identifiers is associated with a token that includes a stream number for identifying a particular communication channel between the peripheral device and the hub device, and the peripheral device identifier.

245. The peripheral device according to claim 221, wherein the peripheral device identifier is associated with a network address.

246. The peripheral device according to claim 221, wherein the message to indicate the availability of the hub device for peripheral device attachment includes a heartbeat signal.

247. The peripheral device according to claim 221, wherein the message to indicate the availability of the hub device for peripheral device attachment is an initial message.

248. The peripheral device according to claim 221, wherein the peripheral device is operable such that an attachment process is initialized with the message to indicate the availability of the hub device for peripheral device attachment.

249. The peripheral device according to claim 221, wherein the peripheral device is operable such that the message to indicate the availability of the hub device for peripheral device attachment is received repeatedly.

250. The peripheral device according to claim 221, wherein the peripheral device is configured to cause the transceiver to follow a protocol that involves a plurality of data blocks and a plurality of status blocks that each include a channel identifier, in association with transmission of data multiple times.

251. The peripheral device according to claim 221, wherein the sent message includes a hub device identifier.

252. The peripheral device according to claim 221, wherein the peripheral device is operable such that an attachment process is initialized with the message to indicate the availability of the hub device for peripheral device attachment.

253. The peripheral device according to claim 221, wherein the message indicating the availability of the peripheral device includes an attachment peripheral device identifier.

254. The peripheral device according to claim 253, wherein the attachment peripheral device identifier is initially provided by the peripheral device after the message to indicate the availability of the hub device for peripheral device attachment is sent.

255. The peripheral device according to claim 253, wherein the attachment peripheral device identifier is received from the peripheral device in response to the message to indicate the availability of the hub device for peripheral device attachment.

256. The peripheral device according to claim 221, wherein the message indicating the availability of the peripheral device includes a temporary peripheral device identifier, for use during an attachment process.

257. The peripheral device according to claim 221, wherein the peripheral device is operable such that: one of the MAC addresses is used for identification in association with a first entity of the peripheral device and another one of the MAC addresses is used for identification in association with a second entity of the peripheral device; the first entity includes a first controller and the second entity includes a second controller; the peripheral device attachment is capable of being automatic; at least three of the MAC addresses are capable of existing simultaneously in association with the peripheral device which includes a single physical device; the transceiver is caused to follow a protocol that involves a plurality of data blocks and a plurality of status blocks that each include a channel identifier, in association with transmission of data multiple times; a first one of the MAC addresses is utilized for attachment purposes and a second one of the MAC addresses is utilized for data transfer; the first one of the MAC addresses is initially used for the attachment purposes in association with the peripheral device without use of the second one of the MAC addresses, after which the second one of the MAC addresses is utilized; and the first one of the MAC addresses has a first one or more channels associated therewith with a capability of transferring a first amount of data and the second one of the MAC addresses has a second one or more channels associated therewith with a capability of transferring a second amount of data that is different than the first amount of data.

258. The peripheral device according to claim 257, wherein the peripheral device is operable such that the plurality of MAC addresses is used by a link layer embodied on a computer readable medium that resides between a physical

layer and a network layer embodied on the computer readable medium, and is responsible for assignment of the plurality of MAC addresses.

259. The peripheral device according to claim **257**, wherein the peripheral device is operable such that an attachment process is initialized with the message to indicate the availability of the hub device for peripheral device attachment; the message to indicate the availability of the hub device for peripheral device attachment is sent repeatedly; i)-vi) are communications associated with the attachment process; the transceiver is caused to communicate between the hub device and the peripheral device, utilizing one or more additional identifiers; and a memory is included with a control structure embodied thereon that performs network bandwidth control.

260. The peripheral device according to claim **221**, wherein the peripheral device identifier includes a newly-selected address.

261. The peripheral device according to claim **221**, wherein the peripheral device identifier includes a previously-assigned address.

262. The peripheral device according to claim **221**, wherein the peripheral device is configured for reattachment.

263. The peripheral device according to claim **262**, wherein the reattachment involves an attach request using a previously-assigned address.

264. The peripheral device according to claim **262**, wherein the reattachment involves an attach request using a newly-selected address.

265. The peripheral device according to claim **221**, wherein at least i)-iv) are communications associated with an attachment process.

266. The peripheral device according to claim **221**, wherein i)-vi) are communications associated with an attachment process.

267. The peripheral device according to claim **221**, wherein iv) includes a confirmation message.

268. The peripheral device according to claim **221**, wherein v) includes a confirmation message.

269. The peripheral device according to claim **221**, wherein vi) includes an acknowledgement message.

270. The peripheral device according to claim **221**, wherein i)-vi) are the only communications associated with an attachment process.

271. The peripheral device according to claim **221**, wherein no other communications occur between i)-ii), no other communications occur between ii)-iii), no other communications occur between iii)-iv), no other communications occur between iv)-v), and no other communications occur between v)-vi).

272. The peripheral device according to claim **221**, wherein the peripheral device is configured to receive keep-alive messages from the hub device.

273. The peripheral device according to claim **221**, wherein the peripheral device is configured to cause the transceiver to communicate between the hub device and the peripheral device, utilizing one or more additional identifiers.

274. The peripheral device according to claim **273**, wherein the one or more additional identifiers includes a stream identifier.

275. The peripheral device according to claim **273**, wherein the one or more additional identifiers indicates a direction of a data transfer.

276. The peripheral device according to claim **273**, wherein the one or more additional identifiers indicates a size of a data transfer.

277. The peripheral device according to claim **273**, wherein the peripheral device is operable such that the one or more additional identifiers is received from the hub device.

278. The peripheral device according to claim **273**, wherein the peripheral device is operable such that the one or more additional identifiers is used to further identify communications between the hub device and the peripheral device.

279. The peripheral device according to claim **273**, wherein the one or more additional identifiers includes a stream number for identifying a communication channel between the peripheral device and the hub device.

280. The peripheral device according to claim **279**, wherein the communication channel is uni-directional.

281. The peripheral device according to claim **273**, wherein the one or more additional identifiers are included in a token.

282. The peripheral device according to claim **281**, wherein the token includes a stream number.

283. The peripheral device according to claim **282**, wherein the stream number is for identifying a particular communication channel between the peripheral device and the hub device.

284. The peripheral device according to claim **282**, wherein the stream number is for identifying a particular communication channel between the peripheral device and the hub device, and an address for the peripheral device.

285. The peripheral device according to claim **221**, wherein the peripheral device is configured to cause the transceiver to communicate via a communications protocol shared by the hub device and the peripheral device to synchronize timing of the communication.

286. The peripheral device according to claim **285**, wherein the communications protocol includes a plurality of frames.

287. The peripheral device according to claim **286**, wherein each of the frames includes a signal that marks a start of the frame.

288. The peripheral device according to claim **286**, wherein each of the frames is associated with at least one data transfer opportunity that permits the hub device to communicate a data block with the peripheral device.

289. The peripheral device according to claim **221**, wherein the peripheral device includes a memory including a link layer control structure embodied thereon that performs network bandwidth control.

290. The peripheral device according to claim **221**, wherein the peripheral device includes a memory including a control structure embodied thereon that performs token planning.

291. The peripheral device according to claim **221**, wherein the peripheral device includes a memory including a network interface structure embodied thereon that determines whether or when to schedule a data transfer, and a link layer transport structure embodied thereon that provides a reliable data transfer for a network interface.

292. The peripheral device according to claim **221**, wherein the peripheral device includes a memory including a link layer transport structure embodied thereon that provides a reliable data transfer for a network interface.

293. The peripheral device according to claim **221**, wherein the peripheral device includes a memory including a link layer control structure embodied thereon that performs token planning.

294. The peripheral device according to claim **221**, wherein the peripheral device includes a memory including a structure embodied thereon that provides a reliable data transfer for a network interface.

295. The peripheral device according to claim 221, wherein at least one of the hub device and the peripheral device is further configured to transfer the same data in multiple forms.

296. The peripheral device according to claim 295, wherein a stream on which the data is communicated indicates a form of transfer.

297. The peripheral device according to claim 295, wherein at least one of the hub device and the peripheral device is further configured to combine the multiple forms of the same data to reconstruct the data.

298. The peripheral device according to claim 295, wherein the multiple forms include an original form and at least one of a complemented form and a reverse order form.

299. The peripheral device according to claim 295, wherein the multiple forms include at least one of a complemented form and a reverse order form.

300. The peripheral device according to claim 221, wherein the peripheral device is further configured to schedule transmission of a status block from the peripheral device.

301. The peripheral device according to claim 300, wherein the peripheral device is operable such that a transmission of data from the peripheral device is scheduled when the status block from the peripheral device indicates that the peripheral device has data ready for transmission to the hub device.

302. The peripheral device according to claim 221, wherein the peripheral device is operable such that the plurality of MAC addresses is capable of being used to identify virtual peripheral entities associated with the peripheral device, the peripheral device attachment is automatic, at least three MAC addresses are capable of existing simultaneously, a first one of the MAC addresses is utilized for attachment purposes, and a second one of the MAC addresses is utilized for data transfer.

303. The peripheral device according to claim 221, wherein the peripheral device is operable such that a first one of the MAC addresses is utilized for attachment purposes.

304. The peripheral device according to claim 303, wherein the peripheral device is operable such that a second one of the MAC addresses is utilized for data transfer.

305. The peripheral device according to claim 304, wherein the peripheral device is operable such that the first one of the MAC addresses is also used for data transfer.

306. The peripheral device according to claim 303, wherein the peripheral device is operable such that a second one of the MAC addresses is utilized for non-attachment purposes.

307. The peripheral device according to claim 221, wherein the peripheral device is operable such that a first one of the MAC addresses has a first plurality of channels associated therewith and a second one of the MAC addresses has a second plurality of channels associated therewith.

308. The peripheral device according to claim 307, wherein the first plurality of channels include channels supported by the first MAC address.

309. The peripheral device according to claim 307, wherein the first plurality of channels include active channels supported by the first MAC address.

310. The peripheral device according to claim 307, wherein the peripheral device is operable such that different channels are utilized for different functions.

311. The peripheral device according to claim 221, wherein the peripheral device includes a transceiver and digital control logic integrated on a single integrated circuit.

312. The peripheral device according to claim 221, wherein the peripheral device includes a host, a transceiver, and digital control logic integrated on a single integrated circuit.

313. The peripheral device according to claim 221, and further comprising: a software architecture embodied in memory including a link layer driver layer, a link layer transport layer, a network interface layer, and a link layer control layer.

314. The peripheral device according to claim 221, and further comprising: a software architecture embodied in memory including i) a link layer driver layer, ii) a link layer transport layer, and iii) a network interface layer, where i) resides below ii), and ii) resides below iii).

315. The peripheral device according to claim 221, wherein the peripheral device is operable such that a first one of the MAC addresses has a first plurality of channels associated therewith with a capability of transferring a first amount of data and a second one of the MAC addresses has a second plurality of channels associated therewith with a capability of transferring a second amount of data less than the first amount of data.

316. The peripheral device according to claim 315, wherein the first amount of data is provided utilizing a first data block size, and the second amount of data is provided utilizing a second data block size.

317. The peripheral device according to claim 221, wherein the peripheral device is operable such that a first one of the MAC addresses has a plurality of channels associated therewith with a capability of transferring an amount of data that has an associated maximum size.

318. The peripheral device according to claim 221, wherein the peripheral device is operable such that a plurality of streams are partitioned between the MAC addresses.

319. The peripheral device according to claim 221, wherein the circuitry includes a processor.

320. The peripheral device according to claim 221, wherein the peripheral device includes a first peripheral device that is a component of a system, the system further including a second peripheral device.

321. The peripheral device according to claim 320, wherein the system further includes the hub device.

322. The peripheral device according to claim 221, wherein the peripheral device is operable such that i) occurs before ii), ii) occurs before iii), iv) occurs before v), and vi) occurs before v).

323. The peripheral device according to claim 221, wherein the peripheral device is operable such that only a first one of the MAC addresses is initially used for identification in association with the peripheral device, after which a second one of the MAC addresses is utilized.

324. The peripheral device according to claim 221, wherein the peripheral device is operable such that only a first one of the MAC addresses is initially used for identification in association with the peripheral device, after which a second one of the MAC addresses is utilized simultaneously with the first MAC address.

325. The peripheral device according to claim 221, wherein the peripheral device is operable such that a first one of the MAC addresses is used for identification in association with a first entity of the peripheral device, and a second one of the MAC addresses is used for identification in association with a second entity of the peripheral device.

326. The peripheral device according to claim 325, wherein the first entity includes a first controller, and the second entity includes a second controller.

327. The peripheral device according to claim 221, wherein the peripheral device is operable such that a first one of the MAC addresses has a first plurality of channels associated therewith with a first capability and a second one of the MAC addresses has a second plurality of channels associated therewith with a second capability different from the first capability.

328. The peripheral device according to claim 221, wherein the peripheral device is operable such that a first one of the MAC addresses has a first plurality of channels associated therewith with a first communication purpose and a second one of the MAC addresses has a second plurality of channels associated therewith with a second communication purpose different from the first communication purpose.

329. The peripheral device according to claim 221, wherein the peripheral device is operable such that data is sent via a first channel, and the data is also sent via a second channel.

330. The peripheral device according to claim 329, wherein the peripheral device is operable such that the data is sent via the first channel using a first format, and the data is sent via the second channel using a second format.

331. The peripheral device according to claim 221, wherein the signal includes an attachment-related message.

332. The peripheral device according to claim 221, wherein the peripheral device is operable such that the plurality of MAC addresses is capable of being used to identify virtual peripheral entities associated with the peripheral device, where the peripheral device includes a single physical device.

333. The peripheral device according to claim 332, wherein the virtual peripheral entities include virtual devices.

334. The peripheral device according to claim 221, wherein the peripheral device is configured to respond in connection with each of the plurality of MAC addresses.

335. The peripheral device according to claim 221, wherein the peripheral device is further configured to associate a plurality of active communication streams with each of the plurality of MAC addresses.

336. The peripheral device according to claim 221, wherein the peripheral device includes a plurality of virtual peripheral devices.

337. The peripheral device according to claim 221, wherein the peripheral device attachment is automatic.

338. The peripheral device according to claim 221, wherein the peripheral device includes a computer readable medium with computer code embodied thereon including a transport layer capable of providing enhanced capabilities.

339. The peripheral device according to claim 27, wherein the sent message is a broadcasted message.

340. The peripheral device according to claim 339, wherein the response in iv) includes the peripheral device identifier.

341. The peripheral device according to claim 340, wherein the broadcasted message includes a heartbeat signal.

342. The peripheral device according to claim 340, wherein the broadcasted message is an initial message.

343. The peripheral device according to claim 340, wherein the peripheral device is operable such that an attachment process is initialized with the broadcasted message.

344. The peripheral device according to claim 340, wherein the peripheral device is operable such that the broadcasted message is received periodically.

345. The peripheral device according to claim 340, wherein the broadcasted message includes a hub device identifier.

346. The peripheral device according to claim 345, wherein the hub device identifier includes a MAC address.

347. The peripheral device according to claim 345, wherein the peripheral device is operable such that an attachment process is initialized with the broadcasted message.

348. The peripheral device according to claim 340, wherein the message indicating the availability of the peripheral device includes an attachment peripheral device identifier.

349. The peripheral device according to claim 348, wherein the peripheral device is operable such that the attachment peripheral device identifier is initially received from the peripheral device after the broadcasted message is broadcasted.

350. The peripheral device according to claim 348, wherein the peripheral device is operable such that the attachment peripheral device identifier is received from the peripheral device in response to the broadcasted message.

351. The peripheral device according to claim 340, wherein the message indicating the availability of the peripheral device includes a temporary peripheral device identifier, for use during an attachment process.

352. The peripheral device according to claim 340, wherein the message indicating the availability of the peripheral device includes an attachment peripheral device identifier that is, at least in part, randomly selected.

353. The peripheral device according to claim 340, wherein the message indicating the availability of the peripheral device includes an attachment peripheral device identifier that is selected from a range of identifiers.

354. The peripheral device according to claim 340, wherein the message indicating the availability of the peripheral device includes an attachment peripheral device identifier that is selected by the peripheral device.

355. The peripheral device according to claim 340, wherein the peripheral device identifier includes a newly-selected address.

356. The peripheral device according to claim 340, wherein the peripheral device identifier includes a previously-assigned address.

357. The peripheral device according to claim 340, wherein the peripheral device is configured to cause the transceiver to perform a reattachment function.

358. The peripheral device according to claim 357, wherein the reattachment function involves an attach request using a previously-assigned address.

359. The peripheral device according to claim 357, wherein the reattachment function involves an attach request using a newly-selected address.

360. The peripheral device according to claim 340, wherein at least i)-iii) are communications associated with an attachment process.

361. The peripheral device according to claim 340, wherein at least i)-iv) are communications associated with an attachment process.

362. The peripheral device according to claim 340, wherein iv) includes a confirmation message.

363. The peripheral device according to claim 340, wherein v) includes a confirmation message.

364. The peripheral device according to claim 340, wherein vi) includes an acknowledgement message.

365. The peripheral device according to claim 340, wherein no other communications occur between i) and ii).

366. The peripheral device according to claim 340, wherein no other communications occur between ii) and iii).

367. The peripheral device according to claim 340, wherein the peripheral device is configured to receive keep-alive messages from the hub device.

368. The peripheral device according to claim 340, wherein the peripheral device is configured to cause the transceiver to communicate with the hub device, utilizing one or more additional identifiers.

369. The peripheral device according to claim 368, wherein the one or more additional identifiers includes a stream identifier.

370. The peripheral device according to claim 368, wherein the one or more additional identifiers indicates a direction of a data transfer.

371. The peripheral device according to claim 368, wherein the one or more additional identifiers indicates a size of a data transfer.

372. The peripheral device according to claim 368, wherein the peripheral device is operable such that the one or more additional identifiers is received from the hub device.

373. The peripheral device according to claim 368, wherein the peripheral device is configured such that the one or more additional identifiers is used to further identify communications between the hub device and the peripheral device.

374. The peripheral device according to claim 368, wherein the one or more additional identifiers includes a stream number for identifying a communication channel between the peripheral device and the hub device.

375. The peripheral device according to claim 374, wherein the communication channel is uni-directional.

376. The peripheral device according to claim 368, wherein the one or more additional identifiers is associated with a token.

377. The peripheral device according to claim 376, wherein the token includes a stream number.

378. The peripheral device according to claim 377, wherein the stream number is for identifying a particular communication channel between the peripheral device and the hub device.

379. The peripheral device according to claim 377, wherein the stream number is for identifying a particular communication channel between the peripheral device and the hub device and an address for the peripheral device.

380. The peripheral device according to claim 340, wherein the peripheral device is configured to cause the transceiver to communicate via a communications protocol shared by the hub device and the peripheral device to synchronize timing of the communication.

381. The peripheral device according to claim 380, wherein the communications protocol includes a plurality of frames.

382. The peripheral device according to claim 381, wherein each of the frames includes a signal that marks a start of the frame.

383. The peripheral device according to claim 381, wherein each of the frames includes at least one token transmission that identifies at least one data transfer opportunity that permits the hub device to communicate a data block with the peripheral device.

384. The peripheral device according to claim 340, wherein the peripheral device includes a memory including a control structure embodied thereon that performs network bandwidth control.

385. The peripheral device according to claim 340, wherein the peripheral device includes a memory including a link layer control structure embodied thereon that performs token planning.

386. The peripheral device according to claim 340, wherein the peripheral device includes a memory including a network interface structure embodied thereon that determines whether or when to schedule a data transfer, and a link layer transport structure embodied thereon that provides a reliable data transfer for a network interface.

387. The peripheral device according to claim 340, wherein the peripheral device includes a memory including a link layer transport structure embodied thereon that provides a reliable data transfer for a network interface.

388. The peripheral device according to claim 340, wherein the peripheral device includes a memory including a control structure embodied thereon that performs token planning.

389. The peripheral device according to claim 340, wherein the hub device includes a memory including a link layer transport structure embodied thereon that provides a reliable data transfer for a network interface.

390. The peripheral device according to claim 340, wherein at least one of the hub device and the peripheral device is further configured to transfer the same data in multiple forms.

391. The peripheral device according to claim 390, wherein a stream on which the data is communicated indicates a form of transfer.

392. The peripheral device according to claim 390, wherein at least one of the hub device and the peripheral device is further configured to combine the multiple forms of the same data to reconstruct the data.

393. The peripheral device according to claim 390, wherein the multiple forms include an original form and at least one of a complemented form and a reverse order form.

394. The peripheral device according to claim 390, wherein the multiple forms include at least one of a complemented form and a reverse order form.

395. The peripheral device according to claim 340, wherein the hub device is further configured to schedule transmission of a status block from the peripheral device.

396. The peripheral device according to claim 395, wherein the hub device is further configured to schedule transmission of data from the peripheral device when the status block from the peripheral device indicates that the peripheral device has data ready for transmission to the hub device.

397. The peripheral device according to claim 221, wherein the peripheral device includes a cellular phone.

398. The peripheral device according to claim 221, wherein the peripheral device includes a computer.

399. The peripheral device according to claim 221, wherein the peripheral device includes a movement sensor.

400. The peripheral device according to claim 221, wherein the peripheral device includes a bar code scanner.

401. The peripheral device according to claim 340, wherein the peripheral device is configured to cause the transceiver to communicate with the hub device utilizing a plurality of additional identifiers, the peripheral device being configured such that the plurality of additional identifiers is used to further identify communications between the hub device and the peripheral device.

* * * * *

CERTIFICATE OF SERVICE

I hereby certify that, on the 20th day of August 2013, I served copies of the Brief of Plaintiffs-Appellants Azure Networks, LLC and Tri-County Excelsior Foundation on the parties listed below via the CM/ECF notification system and by electronic means:

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CERTIFICATE OF COMPLIANCE

In accordance with Federal Rule of Appellate Procedure 32(a)(7)(C), the undersigned certifies that this brief complies with the applicable type-volume limitations. Exclusive of the portions exempted by Federal Rule of Appellate Procedure 32(a)(7)(B)(iii) and Federal Circuit Rule 32(b), this brief contains 11,779 words. This certificate was prepared in reliance on the word count of the word-processing system (Microsoft Office Word 2007) used to prepare this brief.

The undersigned further certifies that this brief complies with the typeface and type style requirements of Federal Rule of Appellate Procedure 32(a)(5) and (a)(6) because it has been prepared in a proportionally spaced typeface using Microsoft Office Word 2007 in 14-point Times New Roman font.

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